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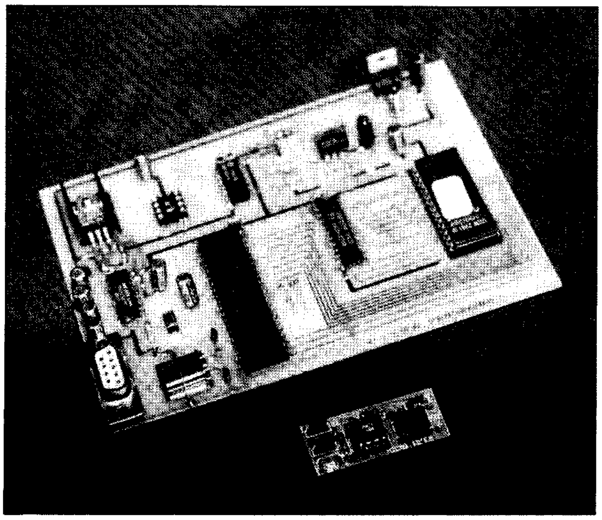

Build this automatic Morse identifier . . . see page 18.

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Recharge all of your NiCd cells with this versatile, easy-to-build project. See page 34.

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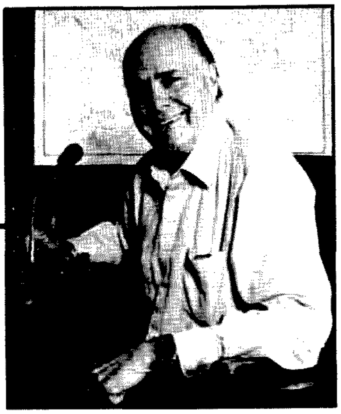
Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Stop That Damned Noise!

Is that your normal response when you hear opportunity knocking? This came to mind when I got several letters recently from readers thanking me for getting them off their fat lazy butts and thinking about making money. There are endless opportunities, it's just that most of us are not tuned to that wavelength, so we don't see 'em. Yet, I'll bet there are dozens of readers who are bitching because they don't have enough money for this or for that. Whine . . . I can't afford those new expensive rigs . . . whine. Oh, baloney!

You can have anything you want . . . if you really want it and are willing to spend some time and effort. Opportunities lie everywhere. I see 'em every day and I think, Lordy, if I just find a couple more people with an interest in working, what fun we'd have with that idea! And I wonder why no one else has thought of anything so obvious. Well, maybe that's why I have a Ph.D. in Entrepreneurial Science and you don't.

Let me give you a "for instance." I subscribe to a bunch of magazines and buy a lot of stuff by mail, so I'm on endless sucker lists. The other day this resulted in a stack of catalogs from Home Automation Laboratories (HAL). I looked through them and thought, what a great opportunity for hams to go into business selling and installing home automation and security products in their neighborhoods. The catalog is packed with hundreds of great gadgets. The outfit is in Smyrna GA 30082-5141, it they missed sending you a catalog.

Then There's the Music Business

The music industry is in chaos these days. Wherever there's chaos, there's opportunity, and the opportunities in the music field are endless today. I know I'm having a ball. There are so many things that can be done I hardly know which way to turn next.

Let me be specific. Let's say you'd like to make some change in your spare time. Sure, you're afraid to quit your 9-5 and step off the cliff as an entrepreneur. You don't have to. If you invest maybe $2,000 tops in a digital audio tape recorder and a good stereo microphone set, you'll be in business. With a little shopping you might even find used stuff for half that.

Who should you record? Well, how about tackling any large city and recording the street musicians? There are some fabulous musicians working the streets of every big city in the world. All you have to do is record 'em . . . preferably playing their own music . . . and I'll take it from there. I'm set up to make the CDs and cassettes, complete with the liner notes, bar codes, and so on. Further, I can get you started with promotion in music publications read by consumers and the record store buyers. I'm already distributing music for over 500 record companies, so I know the ropes. There are a zillion people who'd love to start collecting a set of street musician performances from cities around the world.

I've heard marvelous performers in London, Munich, Berlin, Vienna, Cannes, Paris, Amsterdam, New York, Chicago, New Orleans, Philadelphia, Boston, San Francisco, etc. I just wish I had the time to record 'em all. There was even one guy wheeling a grand piano around the New York streets and playing classical music. There are some wonderful steel bands, violinists, great guitar players, and endless Peruvian and Ecuadorian groups.

Think about it. Street performers get eight to 12 hours a day of practice, seven days a week, so unless they've some mental problems, they tend to get awfully good. I discovered Scott Kirby playing his piano on the streets of New Orleans. Today, as a result of my recordings, Scott is recognized as the finest ragtime pianist in the world. He's the only ragtime pianist who's making a living at it just playing his music. Around 99% of our musicians have to have daytime jobs to pay the bills so they can play gigs at night.

You'll be helping yourself as well as the performers. They'd all love to have CDs and cassettes to sell and we can supply 'em, with endless commissions to you. They normally sell the CDs for $15, making $5 on every sale. You make a buck. They sell cassettes for $10 and make $3. You make 66¢. That adds up fast and I really enjoy sending out nice fat commission checks.

Well, obviously only a few people can record street music, so what else is there? Within a few miles of you there are endless musicians. They're everywhere. All performers need CDs and cassettes to sell at their performances. They usually make more selling these than they get for their gigs.

Then there are endless places to find performers. I'm way up in the mountains of New Hampshire, yet in the tiny town of Antrim we've got a blues club in the Rynborn restaurant. Every performer there should be recorded. By the time you have 15 of 'em you've got enough for a CD . . . for both the performers and the club to sell. In Peterborough we've got the Folkway, which attracts many well-known performers, plus there's Latacarta, and Del Rossi's (mostly bluegrass). All three of these restaurants should be recording their artists and helping them sell their CDs and cassettes. There's enough going on just in Peterborough to keep someone busy in their spare time . . . and making very nice money. That's one great thing about recordings, once you have 'em, you can sell 'em for years.

So what's it cost to do all this? I've explained about the equipment. That's simple, though you'll want to get good at placing your stereo mike. It costs about $2,300 to make a thousand CDs. They normally wholesale to distributors for around $7.50, sell to record stores for $10, and retail for $15. The spread between the $2.30 it costs to manufacture the CD, complete with liner notes, tray card, jewel box, shrink wrap, plus three months of promotion in the *Secret Guide to Music, CD Review*, and *Music Retailing*, and the distributor price has to cover the costs of making the DAT recording, further promotion, advertising, and payments on your yacht. If the CD sells at all well you'll see some pretty good money rolling in.

Any club or restaurant that has music should be a good potential customer. Every musical group. How about school (great graduation gift) or town bands? Many companies have bands. In England there are many superb company bands and I've got their CDs to prove it. In Germany there are endless folk music groups that are marvelous. I'll bet I have close to a hundred CDs of German oompah and yodeling groups, and I enjoy every one of them. I've even got a collection of Polish folk singing groups.

In America there are polka bands, square dance bands, country fiddling contests, bluegrass festivals, cajun, zydeco, rap, Dixieland, ragtime festivals, maybe a couple hundred jazz festivals, and so on. These all are ripe for recording

So Who Pays for the CDs?

I'll underwrite the street musician series if you're short of money to get started. But I'll bet I can get it back from Chambers of Commerce. And even if not, I can sell enough of a series like that via mail order and record stores to make it profitable.

But even if you have to finance the CDs yourself, you can be making a profit after the first 250 are sold.

I recommend you record music written by the performers so you'll avoid having to pay copyright royalties. These can come to $1.20 per CD, so they're tough. That's a federal law, so you don't mess with it. Performer royalties are usually 12%. That's about 90¢ per CD. All that brings your investment to about $4.40 per CD. You sell 'em to distributors for $7.50, or to your local record stores or restaurants for $10. $9 to your performer(s).

The Music Industry Chaos

Up until the last two or three years six record companies had a stranglehold on the whole industry. It was a solid cartel. They controlled the major artists, distribution, many of the record stores, virtually all major radio station air play, MTV, and so on. Since five of the six megacorporations are foreign-owned, most of the money from all this is probably being sent abroad. Just in the last couple years, with the formation of the Independent Music Producer's Syndicate (IMPS), this has begun to change. The majors have been fighting back, cutting off advertising to retailers not toeing the line. They've also stopped selling to troublesome retailers, forcing them to buy from the more expensive "one-stops." The majors are trying to stop retailers from selling used CDs. They're trying to stop them from letting customers return any CDs they don't like . . . or even be able to listen to them in the stores before buying.

The result of all this has been a bonanza for the small independent record companies (indies). Record stores are getting angrier and angrier at the majors and are starting to seriously push indie music as an alternative. But we need tons more indie music to fill this need. Good music. The performers are out there, we just have to get 'em on digital tape (DAT) and then make the CDs.

Those are some of the opportunities I see in the music field, but I'll bet that whatever business you're in, if you start thinking, you'll see plenty of exciting ways to make money. You just

Continued on page 84

LETTERS

Number 2 on your Feedback card

From the Hamshack

Sid Wolin K2LJH, Manager, Azden Communications Division, Franklin Square NY We at Azden are very appreciative of your having published a review of our AZ-61 6 meter handheld radio (November '93). While reading it, I noticed a statement that could be misunderstood and would place the radio in a poor light.

Gordon West says, "Unlike the 2 meter version, the Azden 6 meter handheld offers no oddball duplex split." What it should have said was, "Just like the 2 meter version, the Azden 6 meter handheld offers any combination of oddball splits in each of its 40 memories." It is a most versatile radio.

I would appreciate your including a correction in the next available issue.

Sid—Thanks for setting us straight. That AZ-61 sure is a nice little radio . . . David N1GPH

Carl Moore W4MJK, Sparta TN Wayne—Thanks for your editorials, comments, etc., especially the one following Rickey's letter in the September issue. Wayne, you should realize that you could increase your circulation much quicker by telling people what they want to hear, rather than the truth.

Now that we get everything for nothing these days, we no longer have to work for what we get out of life. Hell, today when you graduate, with a degree in Bull-S, you are qualified for CEO of a multinational corporation. If the world fails to recognize your talents, just continue to sponge off of Mom and Dad. Shoot, these are the '90s, do your thing.

I heard my first radio in 1926, the Dempsey-Tunney fight. I've been involved in communications since age 11, when we built our first portable radio. We put a crystal inside a big earphone and wired it up. You could hook onto a barbed-wire fence near Atlanta and hear WSB loud and clear. Of course, the fence wasn't portable.

I have enclosed a photo of the TU-1000 RTTY unit, described in the June 1985 issue of *73*. I built it last year, even though I already had a RTTY unit. I just enjoy the feeling of satisfaction and accomplishment that comes from creating something. I know you have experienced that feeling many, many times during your life. I bet you a buck that if you could get a lot more Americans to experience that feeling, just once, what a wonderful change we would see!

D. E. George WP4XD, Isla Verde, Puerto Rico Dear Charles Warrington: I am addressing this letter to you because I am not sure who or what should get it. Is it "Kaboom," "Carr's Corner," "Ham Help," or "Letters," or all of them?

My problem, and I'm sure other hams who have Heathkits have or will have this problem, is replacement of certain proprietary devices used in some kits. The immediate problem is with two ICs used in the Heath Handheld Frequency Counter Model IM2400. They are identified as Heath p/n 442-698 and p/n 443-937. I've searched my sources for these devices to no avail. HELP!

This poor meter (sad, not bad) went through Hurricane Hugo a few years ago, from which I lost the NiCds and now the High Frequency Channel. The Low Frequency Channel works fine, as did the High Frequency, until last week. In the absence of the NiCds, I've been running off of a regulated power supply. Apparently, this power supply developed a spike(?) which popped these devices. I've temporarily replaced the p/n 442-698 with a MAR-1, but can't find a replacement for the divide-by-10 p/n 443-937 that can operate at 500 MHz! I would appreciate any help you could provide. Thanks in advance.

P.S. I enjoy *73* as it is; please don't change it (including Wayne's ramblings—or should I say rumblings?)

I have a Heath HW5400 that has some output devices: 417-971, 972-8973, that also fall into this category. Fortunately, the HW5400 survived Hugo totally unscathed!

P.P.S. I live about 100 feet from the ocean on the North Shore of Puerto Rico, so we got Hugo full force!

Dan—As it turns out, the Heath Company is still in business. They are no longer producing the catalog of products which made the name Heathkit legendary in ham radio circles. Yet, Heath's downsized descendant continues to provide some support for hams and others who need help.

As fate would have it, the two ICs you seek (Heath p/n 442-698 and p/n 443-937) are in stock and can be ordered direct from Heath Company, P.O. Box 1288, Benton Harbor MI 49023-1288; (616) 925-5899. While Heath Company may not be able to provide all of the technical support they used to back in the old days, they can sometimes refer you to other companies who can. Heath's general information number is (616) 925-6000 . . . Charlie WA1RZW.

Dave Swanson N1MJC, Dennisport MA Wayne, you have interesting editorials, sometimes a little repetitious, but I guess you are trying to drive home your point of view. I read an excerpt on "What's wrong with Peterborough" from your *Declare War* book, sent to me by a friend who knows of you and also knows that I subscribe to *73*. I thought it read very well and made a lot of sense.

My last comment has to do with the CW mode of operation: I also think that with the present state of the art in the communication field, the CW requirement needs an overhaul since it is but one of the many modes of amateur communication. I think CW is a fun mode and a historically significant mode and certain portions of the spectrum should still be allocated for it, but as a requirement for the advanced operating licenses it should be eliminated. My personal choices of communication are limited because, for all practical purposes, I am deaf (flu-related nerve deafness at age 28); I cannot communicate by voice and group club meetings are out, unfortunately. I have no problems with CW, and the tone-deafness mentioned by N8YBK in the September '93 "Letters" column, regarding an individual who couldn't learn the code, is not a correct analysis of that individual's problem. As you would probably agree, the code tone can be at almost any audible frequency and still be copied: it's the duration and spacing, etc., of tones, not the tones themselves, that make the code comprehensible.

Ron Gillies, Lloydminster, Alberta, Canada Wayne, I am a Canadian (mid-30s) who is approaching my exam/license within the next few months. I have been reading the various magazines on the hobby and have consistently found *73* to be the most interesting, provocative and useful of the bunch.

I especially enjoy your editorials, but I have to admit that the September '93 one left me a little at a loss. I have noted that you do not have a lot of time for the ARRL, and that in the mid-1960s (when I was just starting grade school) the ARRL did something that you view as the real death of modern amateur radio.

Without dragging you over ground that you are probably very tired of, can you give me a brief rundown? As a Canadian under 40, I'm afraid that some of the implicit references just shoot over my head.

I am also an avid computer hobbyist (assembled my own Heath from a kit a number of years ago) and I wondered, have you ever thought of starting an echo on one of the major nets, such as Fido? Your editorial material would be great stuff to spread, and the faster timeline for comments could make for very readable fun!

I look forward to more of your writings—they're great fun and make me think about things from different points of view!

Yes, I'm tired of writing the details of the Great Catastrophe of 1964. Someone please write and tell Ron about it . . . Wayne

Daniel Plett 3A2LZ, Monaco Wayne, I have been reading your magazine for about a year now and have enjoyed it thoroughly. The articles seem to be more rooted in reality than most other U.S. amateur radio magazines. Usually I agree with your column, and when I disagree it is a matter of perspective.

For instance, although I'm pretty active on SSB and RTTY, I still operate a lot of CW. This is because I have a lousy antenna and CW can get through where voice won't. Also, on the international scene some hams can only afford a small, low-power, CW-only rig and don't know enough English to communicate with others but *can* get by on CW.

I'm also an Extra Class U.S. license holder and find the current system of exams and licenses lacking. Six levels of licenses and exams is ridiculous. It would make more sense to me to have three levels of licenses. The first would be like the current No-Code Tech, which has proven itself to be an excellent entry-level license. The next would be like the current General license, with at least a 12 wpm code requirement (to fit within CEPT and other reciprocal programs) and a power limit of 100 watts. This would raise a lot of opposition, but isn't uncommon in other parts of the world. You can still do almost anything with 100 watts as you can with more power, with the exception of good moonbounce. It might encourage learning good operating skills, antenna construction, and understanding of propagation instead of just buying and amplifier to cut through it all. Then have the current Extra license, perhaps still at 12 wpm code, but with the higher power and additional frequency allotments. A number of other countries also require that you be licensed three to five years before you are allowed more than 100 watts.

While VE testing is a marvelous step forward, I strongly dislike having the test questions available ahead of time. I don't know how to prevent them from being made public, though.

Recently I spent about eight months in the U.S. and attended a number of hamfests and radio clubs and it seemed that most people's activities were limited to the occasional chat with a friend or on a net on HF, 2 meter FM, and packet radio. I share your sentiments about the lack of building, experimentation, and interest in anything out of the ordinary. I looked in vain everywhere for someone to explain or talk to me about APLINK, for instance, and found hardly anyone who could knowledgeably talk to me about AMSAT. Amateur radio has a proud heritage of experimentation and innovation, but for the most part it seems that U.S. hams almost always look inward, not considering the rest of the world, and use ham radio as an expensive telephone. Let's see some articles on home-brew DSP, possibly putting this and other digital processes into practice. These are some ideas brought about by your column and by my personal experiences in the U.S. and overseas.

QRX . . .

Number 3 on your Feedback card

Ham Nobel Prize Winner

The winner of the 1993 Nobel Prize for physics, Princeton University's Dr. Joseph H. Taylor K1JT, attributes his success in science to his early involvement in amateur radio. Taylor shared the prestigious award with his former student and now Princeton colleague, Dr. Russell A. Hulse.

Upon learning of his winning the prize, Dr. Taylor told reporters that he developed his scientific skills as a ham during his years at Moorestown Friends Academy in New Jersey. He later earned a Bachelors degree from Haverford College and a Doctorate in Astronomy from Harvard University. The Nobel Committee honored Taylor and Hulse for their study of the gigantic gravitational forces exerted by pulsars. *TNX ARRL.*

The Car of the Future

Technology offers new hope for those among us who hate to stop and ask for directions. Commerce Secretary Ron Brown joined automotive industry leaders recently to announce an international agreement which will accelerate the development of practical GPS receivers for motor vehicles.

Many hams are already familiar with the GPS (Global Positioning System) technology. Originally developed by the Department of Defense as a worldwide navigation system for the armed forces, GPS uses satellites to pinpoint the exact locations of special receivers.

Magellan Systems, a California based manufacturer of GPS receivers, will develop, build, and export the units. Experts predict the receivers will be so small and inexpensive they will become a standard feature in new automobiles.

Quick Ticket

The FCC has proposed a measure which would grant temporary operating authority to unlicensed persons who have passed their examinations for new amateur radio licenses. The temporary operating authority would begin when the exam is passed and the application filed. The maximum limit would be 120 days.

The temporary authority would not benefit anyone whose license has been suspended, revoked, or subjected to other FCC enforcement proceedings. The commission reserves the right to yank this operating authority at any time without a hearing.

The Commission says the system ". . . would be useful to the amateur community, yet practical to implement." The proposal, designated P.R.Docket 93-267, was based on a Petition for Rulemaking from the Western Carolina Amateur Society. *TNX Westlink Report, No. 661, November 12, 1993.*

Fork It Over

If you think your last traffic ticket was painful, wait until you see what your friends at the FCC have cooked up for you. The commission's new fine schedule includes a $625 penalty for any "assorted minor violations," and a $1,250 fine for failure to identify your station. Unauthorized use of equipment will cost you $5,000.

Running excessive power, failing to respond to an FCC communication, or operating on an unauthorized frequency will set you back $10,000 under the new fine schedule. Transmitting indecent material or words will cost you $12,500, causing malicious interference to another ham is set at $17,500, and failing to permit an FCC station inspection carries an $18,500 price tag.

If you really want to help reduce the national debt, just get caught sending out a false SOS. Illegal misuse of distress communications like that will cost you $20,000 for each transmission! The FCC has the authority to adjust these fines, but these base amounts are recommended for first-time offenders. *TNX Newsline & Westlink Report, No. 661, November 12, 1993.*

Radio Sleuth Lauded

The FCC recently presented a bronze plaque of appreciation to Melvin I. Woods KN4ZT, of Annandale, Virginia, for his "outstanding assistance" in solving a false distress signal case. The 1992 case involved a false SOS on 14.313 MHz. The commission says Woods not only provided important information at the time, he also cooperated with the subsequent FCC investigation.

The 58-year-old Amateur Extra Class operator served in the US Navy from 1952 to 1976 as a senior chief radioman and chief electronics technician. Woods started in ham radio in 1953 as a Novice. He was also awarded the US Coast Guard Public Service Award from Rear Admiral William J. Ecker during the October ceremony. *TNX Westlink Report, No. 661, November 12, 1993.*

Malfunction Grounds Earthwinds

A November launch attempt for the Earthwinds around-the-world balloon flight was aborted after a system malfunction damaged the crew capsule. Crewmembers Larry Newman KB7JGM, Richard Abruzzo, and Vladimir Dzhanibekov RV3DD were not on board at the time and no one was injured during the mishap.

Project leaders suspect a cable support anchoring the capsule to the ground gave way, causing the capsule to rise prematurely and then fall. The damage is being assessed. The ham-radio-equipped historic balloon flight has been set back a minimum of six to eight weeks. *TNX W5YI Report, Issue #22, November 15, 1993.*

Let's Talk Ham Radio

A Phoenix-based radio talk show called "Ham Radio & More" has gone national after 2-1/2 years of success on station KFNN. The show began broadcasting nationally over more than 80 Talk America Network affiliate stations in late November. The weekly program is hosted by Len Winkler KB7LPW, and features special guests, give-aways, listener call-ins, and DX news.

"Ham Radio & More" can be picked up in any market by a local talk station. You can suggest your favorite station carry the program by having them contact the Talk America Network at (508) 460-0588. The show can also be picked up on Satcom C-5, Transponder 19, 6.0 audio and Galaxy 2, Transponder 3, Channel 55.4. The show is designed to increase the public's awareness of ham radio and thus help the hobby to grow. It includes discussions of all aspects of hamming, and is not limited to technical topics. Listen for it on Sundays at 6 p.m. EST.

Be Prepared

Members of the Amateur Radio Emergency Services group of Mercer County in rural Kentucky had a very authentic training exercise one recent Saturday. Ham operators and other volunteers were staging their response to a mock plane crash when a very real crash occured on nearby Highway 127—an automobile and a large truck had collided.

Using 2 meter gear and a repeater phone patch, Robert James KC4ZOX summoned local authorities and the accident was handled without delay. Despite bad weather and that highway collision, the simulated hunt for the "downed aircraft" was a success. Organizers called the day's work excellent training for the unexpected. *TNX Dan Cordray KD4PWP.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine,* Route 202 North, Peterborough NH 03458. Or get in touch with us on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; or the 73 BBS at (603) 924-9343 (300-2400 baud, 8 data bits, no parity, one stop bit.) News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun.* You can also send news items by FAX at (603) 924-9327.

Number 4 on your Feedback card

Using the World's Most Accurate Frequency Standard, Part 1

Building a receiver for WWVB.

by Bob Roehrig K9EUI

How accurate is your frequency counter? Chances are it is not as good as you think it is. Even if your counter has a high stability time base of 0.1 or 0.2 ppm, it must still be checked against a known standard from time to time. I have seen many counters that are off by as much as 10 ppm, which means the measurement of a 2 meter rig would be off by more than 1 kHz. If you experiment with microwaves, it is essential that you have an accurate frequency counter.

The standard rule of thumb is that your measuring instrument should be at least 10 times more accurate than the device you are trying to measure. See the sidebar: "Comments on Frequency Counters" on page 17.

The most accurate frequency source in this country is obtained from the National Institute of Standards and Technology (NIST), formerly called the National Bureau of Standards (NBS), in Colorado. This is the organization that operates WWV. All the WWV frequencies are obtained from a cesium standard, which is the most accurate frequency source in the world. WWV is OK for setting clocks and zeroing a receiver's crystal calibrator, but it is not the ideal source for checking a frequency counter.

The best standard frequency you can get is from the LF transmissions of WWVB on 60 kHz. Because of the low frequency used, the fading and multipath problems are minimized and an almost constant signal is available. With the equipment described in this article you can easily check your local standard or countertime base to within 0.0001 parts per million, which is not possible using the HF WWV signals.

The WWVB Signal

The WWVB transmission on 60 kHz has no audio modulation. The carrier power is reduced 10 dB at the beginning of each second and held low for 0.2 to 0.8 seconds before returning to full power. This pulse width modulation is a serial binary time-of-day code used to synchronize clocks. The second form of modulation is a 45-degree advance in phase shift at 10 minutes past the hour, which is returned to normal five minutes later. This phase shift will have little effect on our use of the signal but you will see it when doing phase comparisons. The WWVB signal strength is sufficient to be received throughout most of the continental U.S.

System Block Diagram

Figure 1 shows a block diagram of the WWVB receiver/comparator. The receiver is basically a sensitive RF amplifier that amplifies the 60 kHz carrier up to a 5 volt level signal. The carrier frequency is then com-

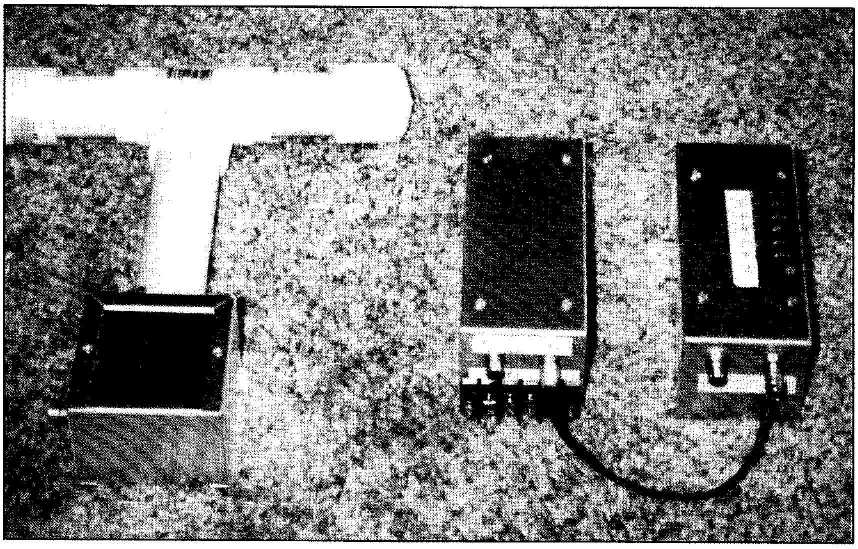


Photo A. Completed WWVB receiver modules with indoor rod antenna.

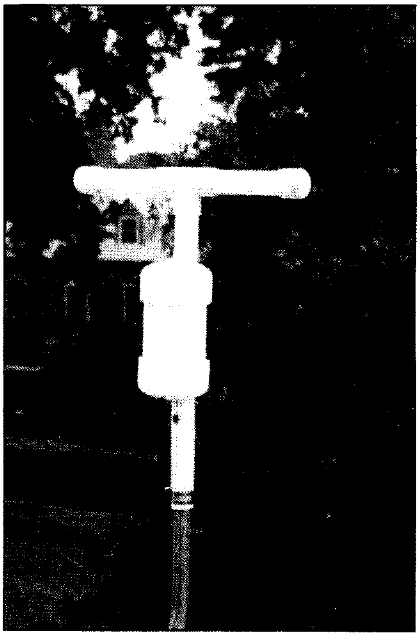


Photo B. Outdoor version of rod antenna and preamp in waterproof housing.

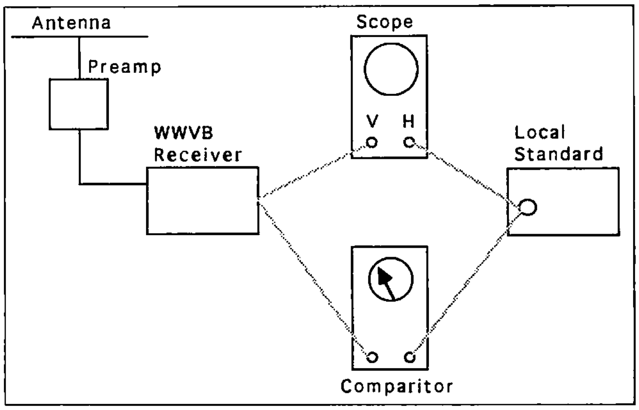


Figure 1. Block diagram of the WWVB receiver/comparator.

pared to your local standard, which may be a separate highly accurate oscillator or a stable oscillator that exists within a piece of equipment such as a frequency counter. The comparator can be either a scope, which is used to observe the Lissajous patterns showing the drift of the local standard, or a digital comparator, which shows the drift rate on a meter or chart recorder. The second part of this article will show the details of a digital comparator.

The Antenna System

This is an active antenna using cascaded followers for a high input impedance and a low output impedance. The unit should be at least 25 feet away from the receiver and is connected to the main unit with coaxial cable. Any common coax can be used since impedance matching is not a critical issue here. Power is supplied from 12 volts via a series 330 ohm resistor in the receiver and the signal is superimposed on this same conductor. The board should be mounted in a waterproof housing if it is to be mounted outdoors. (See Photos A and B.)

Two types of antenna can be used, a wire or a ferrite rod. The same preamp is used for either type antenna with just a few component changes. The antenna/preamp circuit is shown in Figure 2.

For the wire version, a 3- to 50-foot antenna is connected to J2; the length depends on the signal strength at your location. R3 is a fixed 1k resistor and C1, C4, L1, and L2 are not used. To adjust, connect the circuit as shown in Figure 3A and adjust L3 for maximum signal at 60) kHz.

A wire antenna can gather a lot of signal but may also pick up a lot of noise. Also, a longwire antenna may pick up enough HF energy from a nearby ham transmitter to damage the preamp. Therefore, I recommend putting in the extra effort to build the rod antenna.

For the preamp circuit with the rod antenna, install C1, C4 and a 1k pot for R3. C2 should be an 820 pF capacitor. C5, L3, and J2 are not used. L1 consists of a 1/2-inch by 7-1/2-inch-long ferrite rod from Amidon Associates (2216 East Gladwick St., Dominguez Hills CA 90220; 310/763-5770), Part No. R33-050-750. You will also need about 50 feet of #28 gauge enameled wire, also available from Amidon.

Starting about two inches from one end, close-wind about 4-1/2 inches of wire around the rod. Secure the ends of the windings with tape. After L1 is wound, wind a layer of electrical tape around the center portion and wind 20 turns of wire over this area for L2. Be sure to leave about two feet of wire off the ends of the windings to make connections to the preamp.

The rod antenna is adjusted by first powering up the board as shown in Figure 3A and checking for regeneration. Rotate R3 throughout its range. If it does not oscillate, swap the two tickler lead connections on the board. Once oscillation is obtained, reduce the setting of R3 by about 1/16 of a turn, below the point of oscillation. Then connect the generator to points A and B and tune to resonance by adjusting the number of turns of L1 and choosing the correct value of C2, making it resonate at 60 kHz with C1 at mid-capacity.

After tuning, cover the entire winding with electrical tape. Final tuning should be done with C1 after the rod is installed in its PVC housing and its attachment to the preamp enclosure. In my case, the antenna is mounted outdoors (see Photo B) so I mounted the preamp in a 2-inch PVC tube and the antenna housing uses 3/4-inch pipe, end caps and a "T."

If you have some ferrite rods around, try them. I successfully used an 8-inch rod that was used as an AM antenna on an old stereo receiver. On this rod I wound 6 inches of wire (0.33" in diameter), which tuned to 60 kHz with two of the 820 pF caps in parallel.

The WWVB Receiver

To maintain the accuracy of the transmitted frequency, the receiver cannot modify

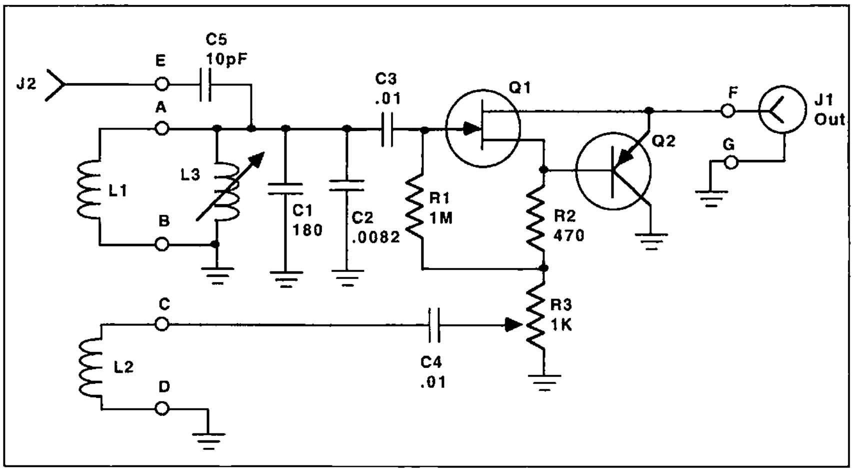


Figure 2. The antenna/preamp circuit.

Parts List, Figure 2

(All fixed resistors 1/4 watt)

R1	1 Meg	
R2	470 ohms	
R3 *	1k	
R3 **	1k pot	Digi-Key #36C13
L1,2 **	See text	
L3 *	800 µH	Digi-Key #TK1725
C1 **	10-180 pF trimmer	Digi-Key #SG3014
C2 *	0.0082 µF	Digi-Key #P3822
C2 **	820 pF (see text)	Digi-Key #P3821
C3	0.01 µF	Digi-Key #P4513
C4 **	0.01 µF	Digi-Key #p4513
C5 *	10 pF	Digi-Key #4837
Q1	MPF102	Digi-Key #MPF102
Q2	2N2907	Digi-Key #2N2907
J1	Output connector: BNC, Phono, or coaxial UHF	
J2 *	Antenna connector: Pin or banana jack	

The enclosure for indoor use is 4" x 2-1/8" x 1-5/8" minibox: Radio Shack #270-239 or Digikey #L114ND.

* Use these parts for the wire antenna version only.

** Use these parts for the ferrite rod antenna version only.

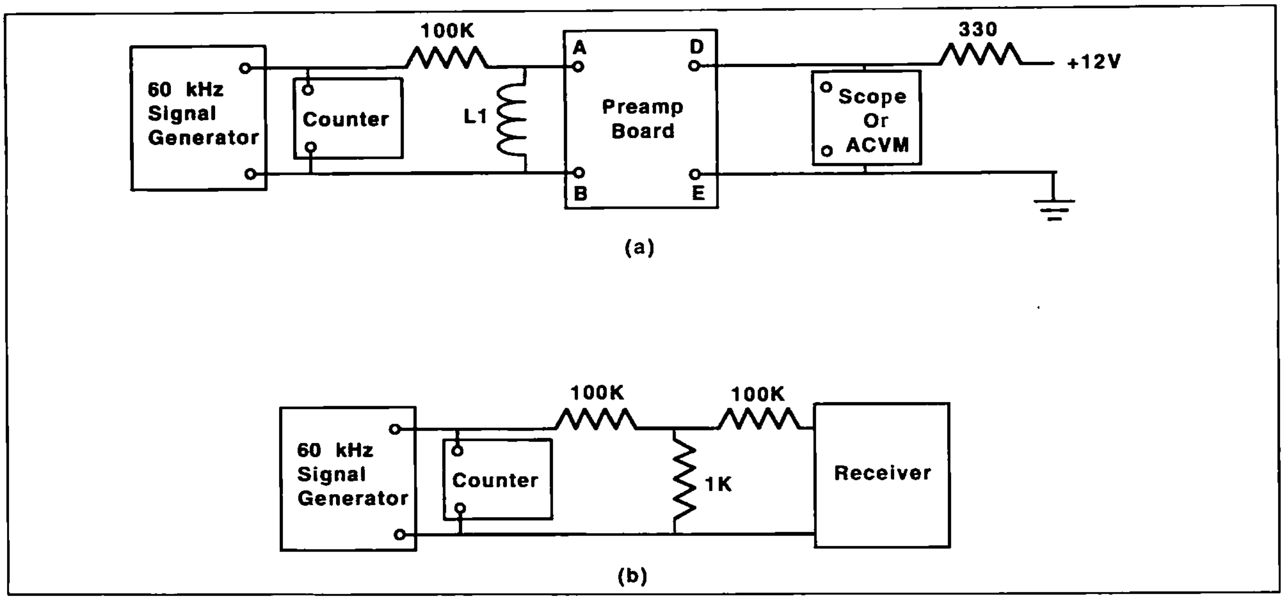


Figure 3. A) Preamp tuning setup; B) Receiver tuning setup.

the frequency in any way, so we must use a TRF system rather than a superhet. Because the entire receiver operates on a single frequency, it must be well-shielded and is therefore built in two separate minibox modules to prevent self-oscillation. RF connections between modules are via coaxial connectors and cables and other connections are provided by barrier-strip screw connections. The receiver design is the result of many months of trying many different circuits and the discreet component version shown here proved to be the most stable and reliable of many that were tried.

The two receiver boards are mounted in the miniboxes using 3/4-inch spacers and 4-40 hardware. The jacks and barrier strips are mounted on the ends and tops of the boxes. The covers may then be mounted to a rack panel or to a cabinet base, as desired. In my final unit, I also included a multi-position switch so I can monitor other functions with the 50 µA meter.

Figure 4 shows the RF amplifier portion

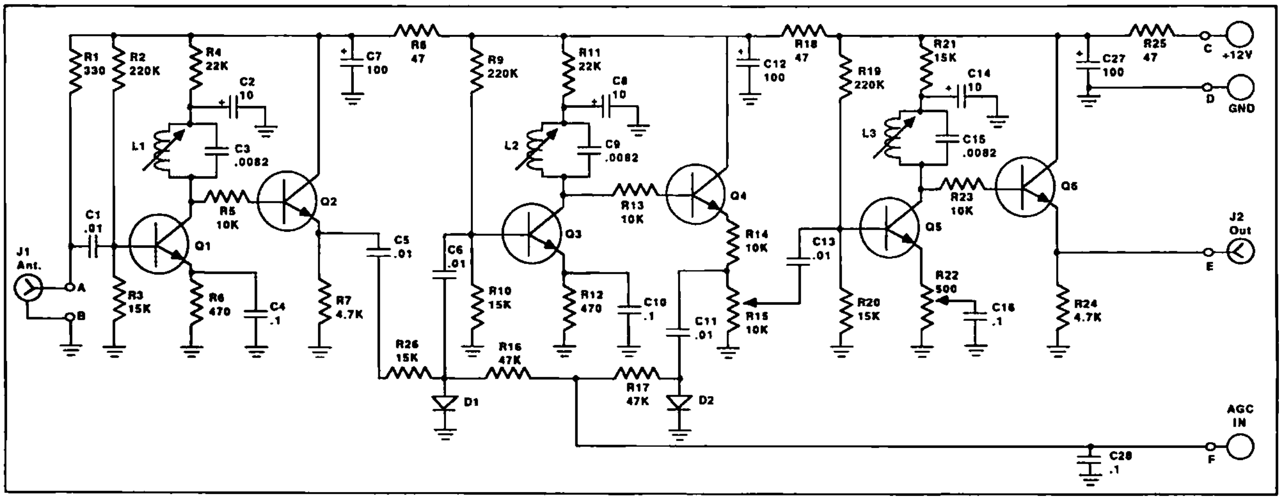


Figure 4. RF amplifier portion of the receiver.

Parts List, Figure 4

(All fixed resistors 1/4 watt)			R22	500 ohm pot	Digi-Key #36C52
R1	330 ohms		C1,5,6,11,13	0.01 µF	Digi-Key #P4513
R2,9,19	220k		C4,10,16,28	0.1 µF	Digi-Key #P4525
R3,10,20,21,26	15k		C3,9,15	0.0082 µF	Digi-Key #P3822
R4,11	22k		C2,8,10	10 µF	Digi-Key #P807
R5,13,14,23	10k		C7,12,27	100 µF	Digi-Key #P833
R6,12	470 ohms		L1,2,3	800 µH	Digi-Key #TK1725
R7,24	4.7k		Q1-6	2N2222 or equiv.	
R8,18,25	47 ohms		D1,2	1N34A	Radio Shack #276-1123
R16,17	47k		J1,2	BNC, phono or UHF coaxial connectors	
R15	10k pot	Digi-Key #36C14	Enclosure: Digi-Key #L116ND or Radio Shack #270-238		

of the receiver. It consists of three stages of tuned amplifiers with emitter followers. The followers and low collector current in the tuned stages help preserve the high Q of the coils to maintain selectivity. AGC is applied to two stages. As the signal strength increases, the AGC detector provides a higher DC voltage. This voltage is applied to diodes D1 and D2. The higher the current that passes through these diodes, the more the signal voltage is shunted to ground. During normal operation the output of this section of the receiver is about a 1 volt P-P sine wave.

Figure 5 shows the remaining amplifier stages and the AGC detector. The normal signal level at TP1 is about 5 volts P-P. The carrier is rectified by D2 and D3. Q6 is a follower to isolate the slow AGC time constant circuit from the detector. C7 is charged to several volts through R23. The discharge time constant is via D5, R24, and R25. The AGC voltage developed across C7 is dropped to less than a volt by D5. The higher AGC voltage is reduced in this way, rather than with a voltage divider, to maintain a greater dynamic range. The slow-responding circuit sets the AGC level relative to the average signal level, rather than allowing it to follow the 10 dB carrier reduction that occurs each second. The slow AGC voltage is available at board point J while the fast AGC voltage is at point H. These two voltages can be used to drive a detector to decode the time-of-day pulse information. This decoded information can be used to operate a self-setting digital clock. If you are interested in such a clock project, drop me a card and let me know.

Stages Q3 through Q5 amplify the main received signal and provide a 5 volt TTL compatible output. This signal is used to drive the 60 kHz input of the comparator unit or to connect to the scope.

Receiver Adjustments

On the RF amplifier board, set R15 and R22 to mid-range. Connect the test equipment to the RF amplifier module alone using the scheme shown in Figure 3B. Using the scope or an AC voltmeter, set the generator to 60 kHz at a level of 150 mV RMS. This is equivalent to a 30 microvolt signal at the actual receiver input. Observe the output signal at J2 with the scope. Carefully adjust the three coils for maximum signal using a nonmetallic tool. The level should end up being about 1 volt P-P.

After alignment is complete, place the cover on the box of the module, then connect the cables between the two receiver units: RF amplifier J2 connects to amplifier unit J1, and "F" of both units are connected together. Temporarily ground the AGC line "F." With the 150 mV signal applied as before, there should be a 6 volt P-P sine wave at TP1. The signal may be slightly clipped at the top and bottom of the waveform. J2 should have a 5 volt square wave. TP2 should read about 6 VDC and TP3 should be about 3.3 VDC.

Remove the short from "F." The signal at TP1 should drop to around 4 volts P-P and TP3 should read around 1.8 volts. If all is well, changing the generator output from 150 mV up to 1.5 volts (a change of 20 dB) should show no more than about a 6 dB change at TP1. With the 50 uA S-meter connected, it should read around mid-scale with the 150 mV input and around 45 uA with the 1.5 volt input.

The receiver will operate with an actual input level of only 3 microvolts with R15 and R22 at maximum level (counterclockwise rotation). With nothing connected to the receiver input, there will be a 5 volt square wave at output J2. This will be close to 60 kHz and is not an oscillation but just the amplification of internal noise. Any useful signal will override this so it is not of concern.

Finally, disconnect the generator and turn it off or change its frequency so the receiver won't pick it up. Connect the cable from the antenna unit and observe the TP1 signal. You should see the 60 kHz signal, around 6 volts P-P or so, dropping in level every second. The signal should be a fairly clean sine wave.

The final gain adjustment is made while

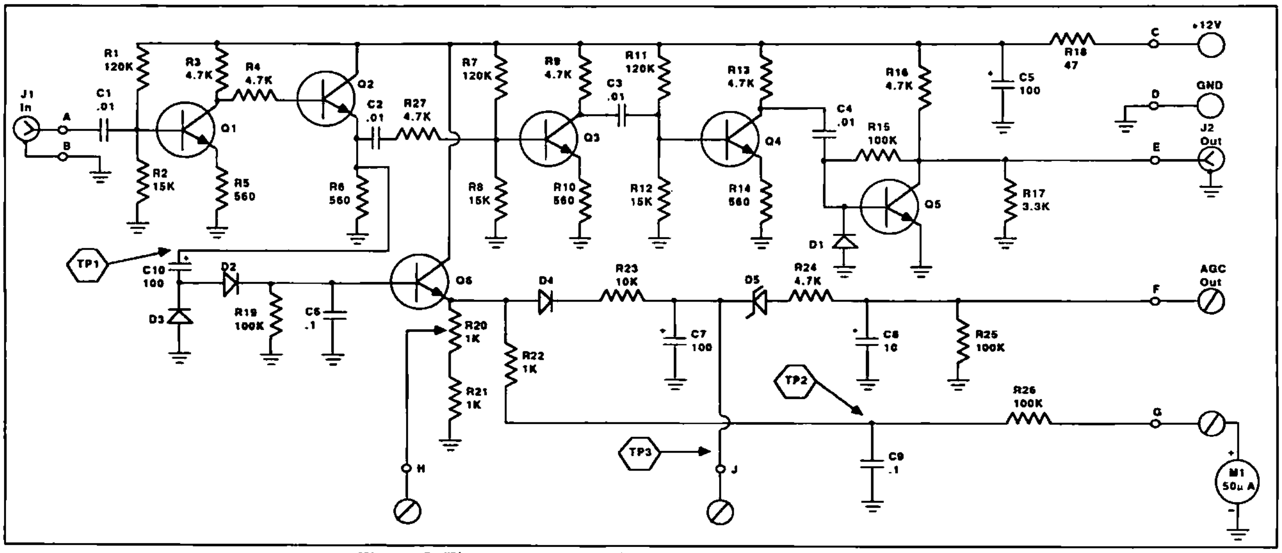


Figure 5. The remaining amplifier stages and the AGC detector.

Parts List, Figure 5

	(All fixed resistors 1/4 watt)	
R1,7,11	120k	
R2,8,12	15k	
R3,4,9,13,16,24,27	4.7k	
R5,6,10,14	560 ohms	
R15,19,25,26	100k	
R17	3.3k	
R18	47 ohms	
R21,22	1k	
R23	10k	
R20	1k pot	Digi-Key #36C13
C1-4	0.01 µF	Digi-Key #P4513

C5,7,10	100 µF	Digi-Key #P833
C6,9	0.1 µF	Digi-Key #P4525
C8	10 µF	Digi-Key #P807
D1-4	1N914 or 1N4148	
D5	3.9V zener, 1N4730A or 1N5228B	
Q1-6	2N2222 or equiv.	
J1-3	BNC, phono, or UHF coaxial connectors	
M1*	50 µA meter	

*Various models available from Fair Radio Co., 1016 E. Eureka, Box 1105, Lima OH 45802; (419) 227-6573

Enclosure: Digi-Key #L116ND or Radio Shack 270-238

observing the signal at its strongest period, usually around noon local time, or four or five hours after sunset. Adjust R15 and R22 on the RF amplifier board for maximum signal at TP1, without clipping. The AGC will then compensate for lower signal levels at other times of day. Maximum signal should peak no higher than 45 µA on the S-meter.

During use, if the meter shows erratic fluctuations other than the normal 1 pps time code drops, it indicates atmospheric disturbances that may affect the signals usefulness. If the meter does not show the 10 dB drops each second, it may be that the noise level is high or you are getting interference. If the meter is steady, the unit may be oscillating because the antenna is too close to the receiver.

Phase Comparisons

The simple form of phase comparison between WWVB and your local standard is done with the setup shown in Figure 1, using a scope. The receiver output is fed to the vertical scope input and the local standard is fed to the horizontal input. The 60 kHz signal and your local standard are compared by observing the rotation of the Lissajous pattern. Alternatively, connect the local signal to the external sync input to synchronize the scope's horizontal oscillator. The comparison will then be a slow drift of the waveform across the screen. In any case, your local standard must be an integer value of 60 kHz.

If your frequency counter time base is your local standard, you can probably find a point in the countertime base divider chain that provides 10 kHz. This would be a good choice of signal to compare to the 60 kHz. At 10 kHz, to achieve an accuracy of 1 part in 10^8, it will take over two hours of comparison time.

Whatever the accuracy you are trying to achieve, it takes 100 times as long to observe a 10 kHz signal drift as it does 1 MHz. For that reason, the serious user of this equipment should consider building a simple digital phase comparator. This will be discussed in the second part of this three-part series.

Using the Receiver for Other Frequencies

WWVB is usable in most of North America. In other parts of the world there are other LF standard frequency transmissions that may be of use. I cannot vouch for the accuracy of the following list but I have seen these stations mentioned in various publications from time to time. There may also be others that I have not heard of. The station must emit a CW carrier and not have FSK keying as many military stations do.

Location	Call	Freq., kHz
U.K.	MSF	60
Germany	DCF77	77.5
Switzerland	HBG	75
Japan	JJF	40
Czechoslovakia	OMA	50
Irkutsk, Russia	RTZ	50

The receiver can be tuned for these other frequencies by selecting different values for C3, C9, and C15 as follows:

40 kHz	0.018 µF
50 kHz	0.012 µF
75 kHz	5300 pF
77.5 kHz	5000 pF

C2 on the antenna preamp board must also be changed as necessary.

I encourage any correspondence regarding this project (314 S. Harrison St., Batavia IL 60510); however, if you expect a response, please include an SASE. A full set of boards for this project can be obtained for $11 plus $1.50 S & H from FAR Circuits, 18N640 Field Court, Dundee IL 60118. 73

Comments on Frequency Counters

If you are planning to purchase a frequency counter, consider the following:

1. The counter specs should state the accuracy and frequency of the time base. Accuracy should be expressed in terms of drift with temperature change. The time base should be one using a "standard" frequency, such as 1, 3, 5, or 10 MHz. Avoid counters which have a nonstandard time base, such as 3.579545 MHz. Nonstandard frequencies generally mean cheap crystals. Also, they cannot easily be compared to a known standard.

2. A good counter should have an output connector which allows you to easily check the internal oscillator.

3. The better counters have an external time base input that allows you to use a more accurate oscillator than the internal one.

4. Unless you can use an external time base, you should consider buying the counter with the high stability time base option, if available, but again, make sure it has an output connector so you can check it.

I have counters made by Hewlett-Packard, Fluke, Anadex, and others. All of these either met the above requirements or were easily modified to do so. Even my synthesized signal generator has an external time base input, so all my units are run from my "house" standard.

5. There are other counters available than those advertised in the amateur publications, such as those I mentioned above. If you frequent hamfests, keep an eye out for older commercial-grade counters. Sometimes excellent units can be purchased inexpensively. The owner may just want to get rid of it because it is not as small as more modern counters.

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Micro IDer

An easy-to-build automatic Morse code station identifier.

by Steve Look KA9SZW and David Pointer

More and more hams these days are attaching miniature radio transmitters to weather balloons, kites, and rockets. This underscores the need for a very small Morse code identifier necessary for legal operation. A very small identifier would also be useful for compact and portable foxhunt transmitters and beacons.

The typical Morse code identifier uses an EPROM and several other logic chips. This confuguration is fine for applications where size, weight, and power consumption are not considerations. The Micro IDer presented here consists of a maximum of 12 components mounted on a single-sided printed circuit board measuring only 1-5/8" x 5/8". The complete unit weighs less than 1/2 gram. Power requirements are 1-2 mA at 3 to 6 volts. One Duracell DL2032 3V lithium cell will power the IDer for hours. Total cost should not exceed $20.

Theory of Operation

The Micro IDer is based on the Xilinx 1736A serial PROM (U2). This eight-pin IC will store 36,288 bits of data. When a clock signal from the 555 timer (U1) is applied to pin 2, each bit in the memory appears at pin 1 in sequence. This pin is connected to the base of transistor Q2 to drive the keying circuit of a transmitter. Q3 and R3 may be needed on the keying circuit to invert the output if you find the code being sent is inverted. Adding the transistor is cheaper than programming a new PROM.

Q1, R4, and R5 form an inverter between pin 6 and pin 3.

When the last bit of the memory has been clocked out, the PROM generates a logic high at pin 6. The inverter applies a momentary logic low to pin 3. This resets the PROM and the entire memory is read out again.

The timing is provided by a CMOS 555 timer in an astable multivibrator configuration. The value of resistor RA sets the clock speed and is determined by the software that generates the actual ID bit pattern. A standard 555 timer may be used instead of the more expensive CMOS part, but the power consumption goes up by a factor of at least 10, greatly affecting the battery life.

Construction

Mount the two ICs first. We recommend only a high quality machine socket for U2 to allow PROM changes. A spring contact socket may cause reliability problems. Mount RA, R1, R2, and R4 on the bottom of the board next. This is done to save space. All the other components can now be mounted to the top of the board.

mkid—A Morse Code Compiler

With this large memory space in the serial PROM available, two programs were written to simplify message generation.

You must first create a file with any text editor (or a word processor in ASCII mode) that contains the text of the Morse code you want to be sent. Be careful about your spelling as the 1736A is a one-time programmable part. All characters are supported, but not the prosigns. Two other characters are included to add a solid tone and silent pause function. A pound sign in your text file represents a solid one-second tone. Place as many of these in a row as you want the tone duration to be. An exclamation point in your text file represents a one-second silence. Place as many in a row as you want the silent period to be.

Text may be entered in upper or lower case as the software converts everything to upper case at compile time. Use a carriage return wherever you wish; they are ignored. When your message looks the way you want it to, save it to disk and exit your text editor.

A very simple example text file may look like:

ka9szw balloon #####

This would generate my (Steve's) call, space, "balloon," space, and then a five-second solid tone. Long periods of a solid tone

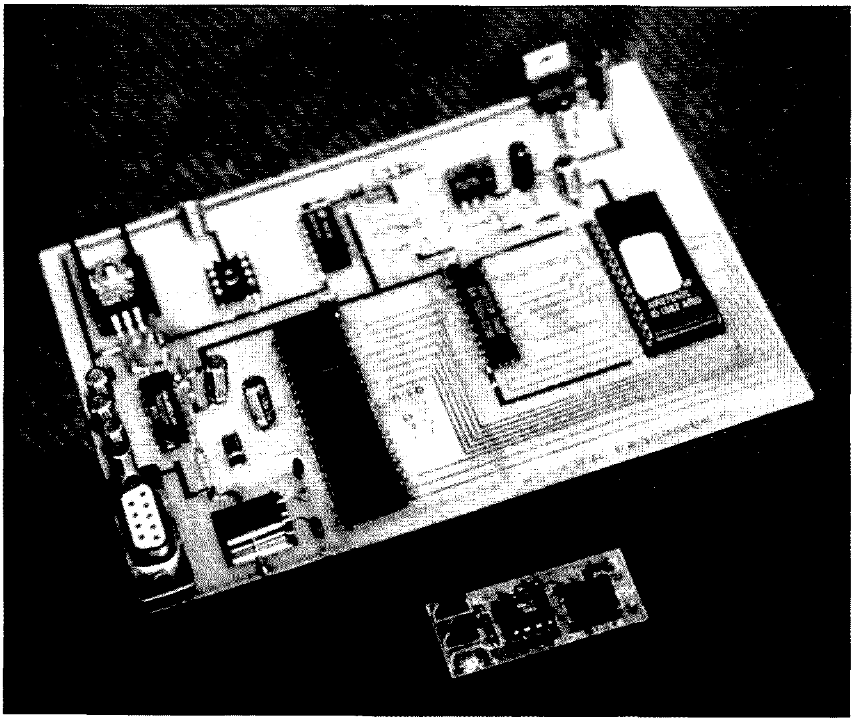


Photo A. Here is the completed Programmer (top) and the IDer.

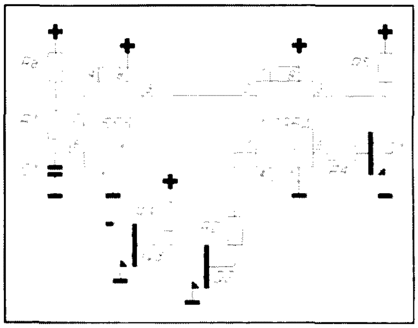


Figure 1. Schematic of the Micro IDer. Q3 and R3 are only used if keying must be inverted.

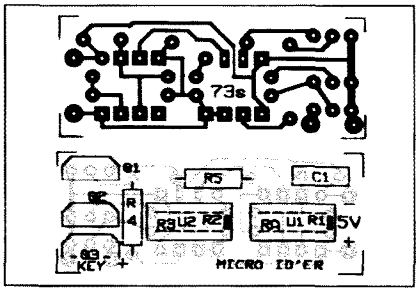


Figure 2. Parts placement outline and circuit board pattern.

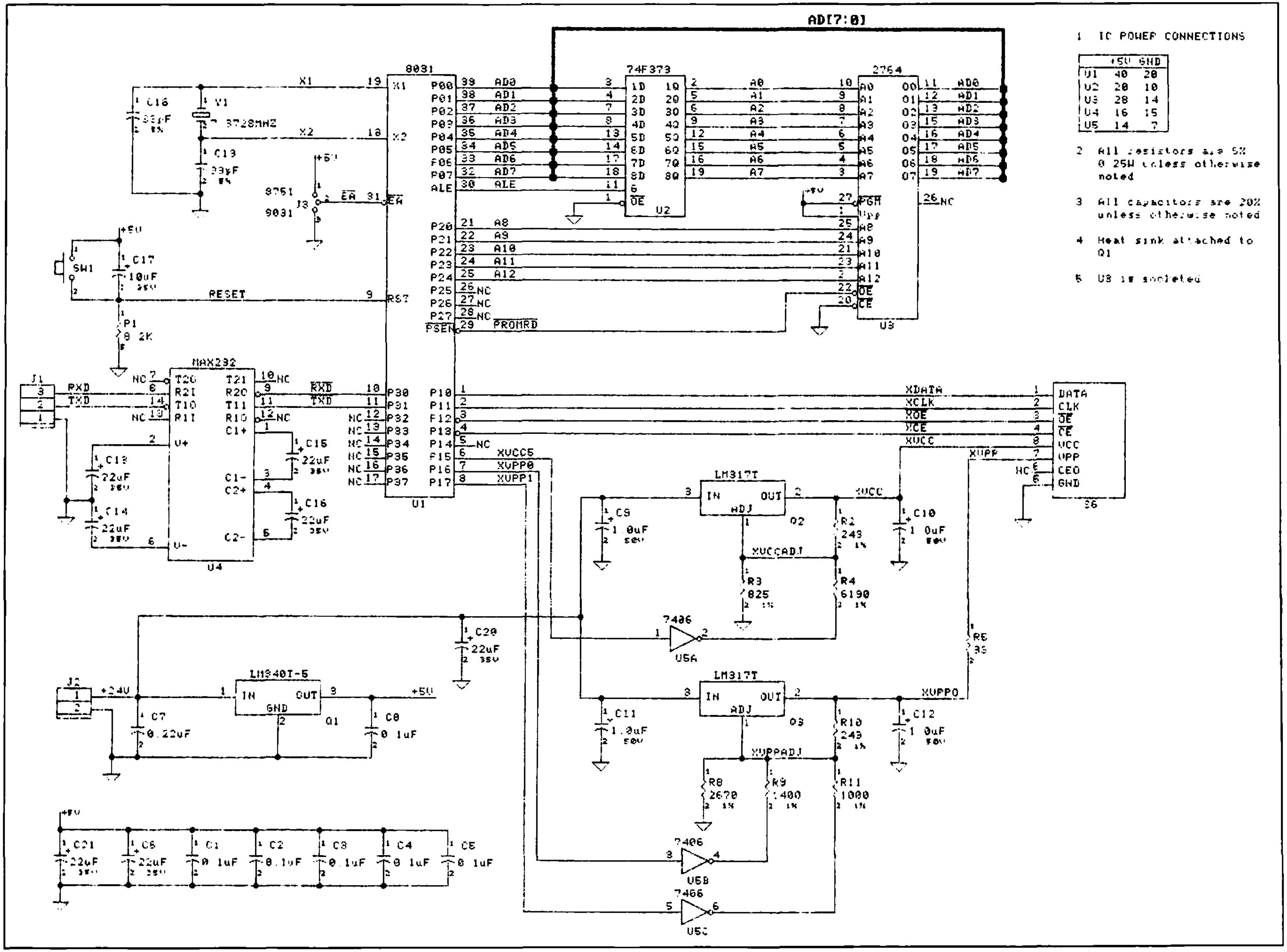
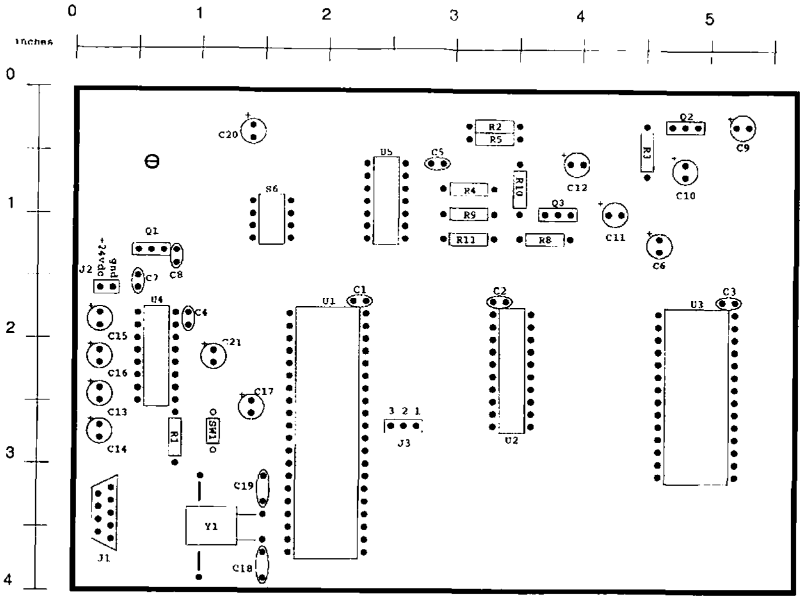


Figure 3. Programmer schematic.



1. Hole sizes (inch dia):
   - ⊖ 0.156 (1 place)
   - ○ 0.052 (2 places)
   - • 0.040 (213 places)
2. Attach heat sink between board and Q1 using 6-32 x 3/8 machine screw, #6 lockwasher, and 6-32 nut.
3. Lay crystal Y1 flat on copper plane, and solder a bare wire strap over Y1 using the two holes provided.

Figure 4. Programmer parts placement @ 70%.

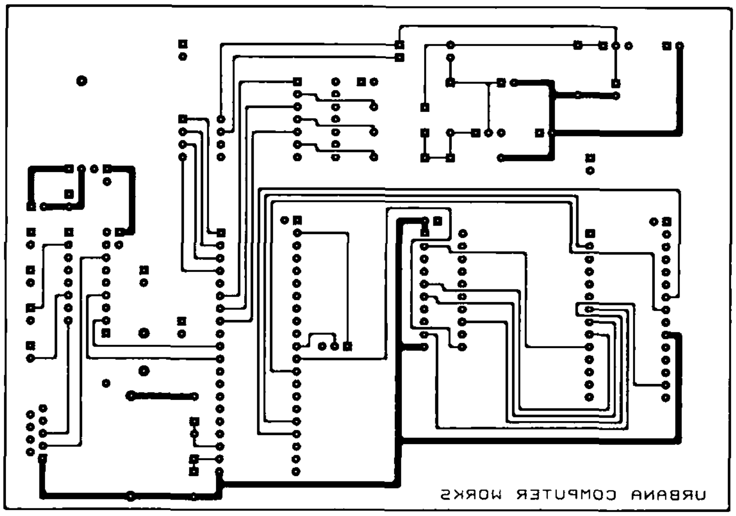


Figure 5. Programmer solder side circuit pattern @ 70%.

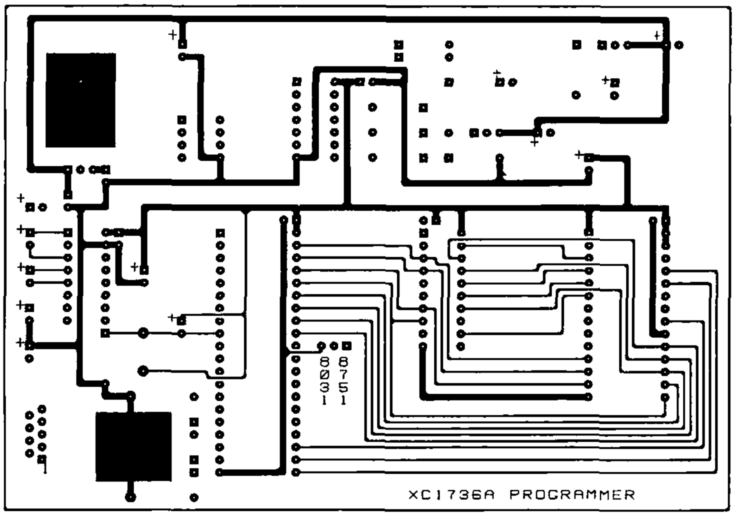


Figure 6. Programmer component side circuit pattern @ 70%.

are helpful to chasers trying to get a fix on a balloon package.

To run the compiler, type:

mkid <text_file>

where <text_file> is the name of the text file you created with the message. The program will display error messages if it cannot find the file. If it has found the file, it will load it while displaying it on the screen so you can check your work one more time. You will be prompted to enter how fast you want the code to be sent. After calculating for a bit you will see a list of available ID delay times. This is how often the message will repeat. Small messages generate large lists of delay times while large messages may offer only a few choices. Enter the number of the delay you wish to use.

After that is done the program opens a file with the same name as the input file, but with a ".jed" extension, and fills it with the keying pattern required for your message.

All the dot and dash timing is done along with key-downs for constant tones. The program will announce when it is done and display some statistics about the ID it just created. The program displays the frequency that the 1736A must be clocked at to get the correct timing, how long the ID will take to send, how long the ID will be silent before restarting, how much of the chip capacity was used, and what the value of the timing resistor (RA) must be.

The file created is in standard JEDEC format and should be accepted by any chip programmer that will handle the Xilinx 1736A, or you can build the companion programmer presented here. Follow the instructions in the manual on how to download a JEDEC file to your particular programmer.

jed2bin—A JEDEC File to Binary File Converter

If you have a programmer that will only accept binary or image files you will also need to use the program "jed2bin." This pro-

gram accepts the ".jed" file and converts it to a binary file. The program prompts you for file names.

All the above programs have been written in generic "C" language to be portable to any computer with a "C" compiler. An executable MSDOS version of each program is available along with the source code.

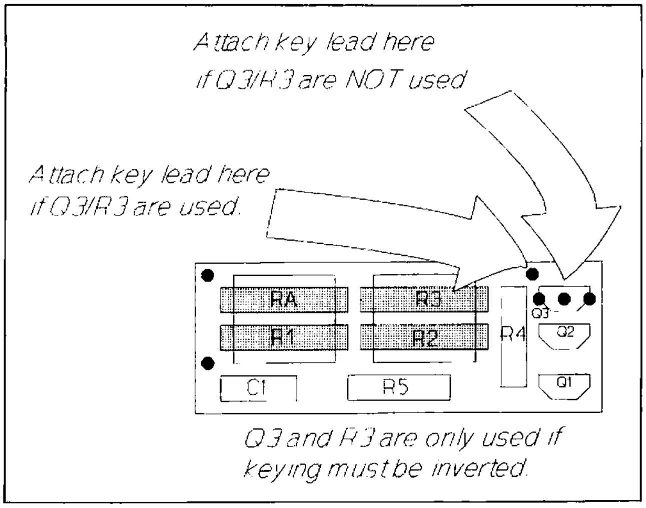


Figure 7. Key wire placement on completed Micro IDer.

The Micro IDer XC1736A PROM Programmer

The Micro IDer XC1736A PROM programmer is an inexpensive alternative for those who want to program an ID into the Micro IDer PROM. Since the least expensive commercial programmer that we know of that can program the XC1736A costs $475, we decided to make this special purpose programmer available to users of the Micro IDer.

The programmer that we developed consists of a board and a host computer program. Communication between the host program and the programmer is through an RS-232 serial port. Power to the board is provided by a 24 VDC wall transformer.

Theory of Operation

The host program "xprog" takes the standard JEDEC file that was produced by the mkid program and sends it to the programmer. An Intel 8031 microcomputer on the programmer board (U1) handles this communication and provides control on the board.

The programmer's 8031 code is contained in a 2764 EPROM (U3). This code has all the programmer's communication routines and the routines that implement the algorithm needed to program the XC1736A. This code is available as an INTEL hex file or already programmed into a 2764 EPROM. The 8751, (which is an 8031 with an EPROM on-chip), may also be used instead of the 8031-latch-2764 combination. Some users may find the 8751 a less expensive alternative to the three-chip combination. A strap on the board (J3) allows for the use of either the 8031 or the 8751.

The XC1736A programming algorithm is complicated. It requires that voltages on two pins be varied between 15V, 6V, 5.5V, and 5V. The programmer controls these voltages by switching various feedback resistors on two LM317 variable voltage regulators. In addition, these voltages must be switched in various combinations before and after serial data is clocked into the device in socket S6. The clock, control, and data lines to the programming socket S6 are connected directly to the 8031 microcomputer.

Q2 can be switched between 5V and 5.5V for the VCC pin of the programming socket. This is controlled by the 8031 microcomputer, which switches R4 in and out of the Q2 resistor network via switching the input of the high voltage open collector inverter U5A.

Q3 can be switched among 5V, 6V, and 15V for the VPP pin of the programming socket. This is also controlled by the 8031, which switches R9 and R11 in and out of the Q3 resistor network using two inverters from the U5 package. R5 provides series damping for VPP, as the overshoot on the VPP pin must never exceed 15.5V.

Construction

The parts placement of the programmer board can be seen in Figure 4. Even though the bare board is two-sided without plated-through holes, it is assembled by soldering all connections that have traces on both sides of the board. The board, which was too complicated to be a single-sided board, was considered too expensive as a double-sided plated-through board. So, we struck a compromise by making sure that all traces could be interconnected by soldering component holes with traces on both sides of a non-plated through hole printed circuit board. This is easily accomplished except in the case of the programming socket S6 and the socket for the EPROM, S3. If the machine screw sockets specified in the Parts List are used, approximately 0.05" of bare metal of the barrel of the socket pin is available for soldering on the component side of the board.

Q1 must have a heat sink attached to it as this device converts the 24 VDC input into 5 VDC, producing a lot of heat in the process. In addition, the crystal Y1 needs to be laid flat and have a bare wire strapped across it. Two holes connected to ground are provided for this purpose.

J2 provides the power connection. A wall transformer that provides unregulated 24 VDC with at least 500 mA of current is re-

XC1736A Prom Programmer Parts List

Reference	Part Description	Manufacturer	Part Number	Digi-Key	Quantity
C1-C5,C8	Cap 0.1µF 63V 20%	Panasonic	ECU-S1J104ZU	P4917	6
C7	Cap 0.22 µF 63V 20%	Panasonic	ECU-S1J224ZU	P4918	1
C9-C12	Cap 1 µF 50V 20%	Panasonic	ECE-A1HU010	P6260	4
C17	Cap 10 µF 35V 20%	Panasonic	ECE-A1VU100	P6248	1
C6	Cap 22 µF 35V 20%	Panasonic	ECE-A1VU220	P6249	7
C13-16,C20,					
C21 C18,C19	Cap 33 pF 100V 5%	Panasonic	ECC-F2A330JCE	P4450	2
Y1	Xtal	7.3728 MHz	CTS	MP074, CTX074	1
R1	Res 8.2k 5% 1/4W			8.2KQ	1
R5	Res 33 5% 1/4W			33Q	1
R2,R10	Res 243 1% 1/4W			243X	2
R3	Res 825 1% 1/4W			825X	1
R11	Res 1000 1% 1/4W			1.00KX	1
R9	Res 1400 1% 1/4W			1.40KX	1
R8	Res 2670 1% 1/4W			2.67KX	1
R4	Res 6190 1% 1/4W			6.19KX	1
U2	IC 74F373 latch	NSC	74F373PC	74F373PC	1
U3	IC 2764 8Kx8 EPROM	Microchip	27C64-15/J-ND	27C64-15/J-ND	1
U5	IC 7406 hex oc inv	NSC	DM7406N	DM7406N	1
U1	IC 8031 micro	Signetics	SCN8031HCCN40		1
U4	IC MAX232 RS232	Maxim	MAX232CPE		1
Q1	LM340 5V 1.5A reg	NSC	LM340T-5	LM340T-5	1
Q2-Q3	LM317 1.5A adj reg	NSC	LM317T	LM317T	2
S3	Skt 28-pin 0.6"	Mill-Max	110-93-628-41-001	ED3628	1
S6	Skt 8-pin 0.3"	Mill-Max	110-93-308-41-001	ED3308	1
J1	Conn 9-pin D-Sub	Norwesco	09S1	509F-ND	1
SW1	Sw mom push-button	Panasonic	EVQ-QEC04K	P8027S	1
	TO-220 heat sink	AAVID	577202B00000	HS107-ND	1
	6-32 x 3/8 mach screw				1
	6-32 hex nut				1
	#6 ext. tooth lock washer				1

Micro IDer Parts List

Reference	Description	Manufacturer	Part #	Digi-Key	Quantity
U1	IC CMOS timer	NSC	LMC555CN	LMC555CN	1
U2	IC serial PROM	Xilinx	XC1736A		1
S2	Skt., 8-pin, 0.3"	Mill-Max	110-93-308-41-001	ED3308	1
Q1-Q3	Transistor, NPN	NSC	2N3904	2N3904	3
RA	*Value determined by software, see text.				1
R1-R5	Res 10k 5% 1/4W			10KQ	5
C1	Cap 0.1 µF 63V 20%	Panasonic	ECU-S1J104ZU	P4917	1

These products available from the authors at Monticello Micro, 727 West Wilson, Monticello IL 61856.

IDER-AT: Assembled and tested, Micro IDer complete with programmed XC1736A PROM, $20 (please include message to be programmed, the time delay between IDs, and code speed).

IDER-CD: Programmed XC1736A PROM alone, $8 (please include message to be programmed, the time delay between IDs and code speed).

XPROG-AT: Assembled and tested XC1736A programmer, $79.

XPROG-CD: Programmed 2764 EPROM with 8031 code, $10. IDER-DISK: 5.25" 360K diskette containing mkld 'C' program source code, mkid program .EXE executable, jed2bin 'C' program source code, jed2bin program .EXE executable, xprog 'C' program source code, xprog program .EXE executable, IBM PC compatible serial port driver source code, XC1736A programmer 8031 object code (Intel HEX format), $5.

Shipping and handling is included in the above.

We assume that you can acquire the 24 VDC 500 mA wall transformer at a hamfest far cheaper than we could provide it to you. For that matter, you probably already have one stashed in your junk box.

The IDer circuit board alone is available from FAR Circuits, 18N640 Field Court, Dundee IL 60196 for $3 plus $ 1.50 S&H. The XC1736A programmer circuit board alone is also available from FAR Circuits for $11 plus $1.50 S&H.

For all orders, please include your name, address, and phone number. Illinois residents please include 6.25% sales tax.

quired to power the programmer board. The wall transformer leads may be soldered directly into the board. You must take care to make sure that the +24 VDC wire of the transformer connects to pin 1 (marked with a "+") on J2.

xprog—a JEDEC to IDer Programmer Board Communication Program

The host program xprog, which is written in "C", is completely portable and can be compiled on any computer that has a serial port and a "C" compiler. The hardware dependent code for the serial port is written as a separate piece of code so that a person may add a serial port driver appropriate for their particular computer. A driver for IBM PC and compatible COM1 and COM2 ports is provided along with the host program source code. Instructions detailing what is required for other serial port drivers is also provided.

The program is invoked by:

xprog <filename>.jcd

where <filename> is the name of the JEDEC file produced by mkid. ■

References:

1) *ABEL Design Software User Manual*, September 1990, DATA I/O Corp., Appendix B: JEDEC Standard Number 3A.

2) *Programmable Gate Array Design Handbook*, 1986, Xilinx Inc., pp. 1-50 to 1-60.

3) *Radio Amateurs Handbook*, 1985, Amateur Radio Relay League, pp. 9-8.

Program 1.

```
/* mkid ver 1.0 - Morse code to JEDEC file convertor.
Copyright (c) 1991 Stephen R. Look
This program is available for unlimited non commercial
distribution. Modifications, bug reports and questions
(SASE please) may be sent to:
Stephen R. Look
727 W Wilson
Monticello, IL 61856
*/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
struct id
{
int      key[1];
char     morse[25];
```

Program 1 continues

```
);
char bits[20000];
char dits[36288];
/*--- function to exit upon invalid character detection ---*/
void char_error()
{
printf("\nerror - the last character displayed is invalid!");
printf("\n        please correct the message text and retry\n");
exit(-1);
}
/*--- function to return correct unit of time ---*/
void time_frame(t,p)
float t;
char *p;
{
if(t>=3600) sprintf(p,"%.1f hrs",t/3600);
else if(t<3600&&t>=60) sprintf(p,"%.1f mins",t/60);
else sprintf(p,"%.1f secs",t);
}
/*---------- main function ----------*/
main(argc,argv)
int argc;
char *argv[];
{
static  struct id reference[44] = {
{ 32 , "00"},              /* SP */
{ 33 , "0"},               /* !  1 second silence marker */
{ 35 , "1"},               /* #  1 second tone marker */
{ 44 , "1111101010111101110"},/* , */
{ 45 , "1110101010101110"},/* - */
{ 46 , "10111010111010110"},/* . */
{ 47 , "1110101011101O"},         /* / */
{ 48 , "1110111011101110111O"},/* 0 */
{ 49 , "10111011101110111O"},/* 1 */
{ 50 , "1010111011101110"},/* 2 */
{ 51 , "10101011101110"},          /* 3 */
{ 52 , "101010101110"},            /* 4 */
{ 53 , "1010101010"},              /* 5 */
{ 54 , "111010101010"},            /* 6 */
{ 55 , "11101110101010"},          /* 7 */
{ 56 , "1110111011101010"},/* 8 */
{ 57 , "111011101110111010"},/* 9 */
{ 63 , "1010111011101010"},/* ? */
{ 65 , "101110"},                  /* A */
{ 66 , "1110101010"},              /* B */
{ 67 , "111010111010"},            /* C */
{ 68 , "11101010"},                /* D */
{ 69 , "10"},                      /* E */
{ 70 , "1010111010"},              /* F */
{ 71 , "1110111010"},              /* G */
{ 72 , "10101010"},                /* H */
{ 73 , "1010"},                    /* I */
{ 74 , "10111011101110"},          /* J */
{ 75 , "1110101110"},              /* K */
{ 76 , "1011101010"},              /* L */
{ 77 , "11101110"},                /* M */
{ 78 , "111010"},                  /* N */
{ 79 , "111011101110"},            /* O */
{ 80 , "101110111010"},            /* P */
{ 81 , "11101110101110"},          /* Q */
{ 82 , "10111010"},                /* R */
{ 83 , "101010"},                  /* S */
{ 84 , "1110"},                    /* T */
{ 85 , "10101110"},                /* U */
{ 86 , "1010101110"},              /* V */
{ 87 , "1011101110"},              /* W */
{ 88 , "111010101110"},            /* X */
{ 89 , "11101011101110"},          /* Y */
{ 90 , "111011101010"} };          /* Z */
long cntr;
int tone,ch,bitcnt,num,refcntr,mcntr,message[1000];
float wpm,time,clk,expandobits,expandoclk;
FILE *in,*out;
```

```
char c[20],*ptr;
ptr=c;
if(argc!=2)
{
printf("Usage: mkid [source_file_name]\n");
exit(-1);
}
in=fopen(argv[1],"r");
if(in==NULL)
{
printf("mkid: %s doesn't exist!\n",argv[1]);
exit(-1);
}
/*------------clear the screen----------------*/
for(cntr=0;cntr<=25;cntr++) printf("\n");
/*------------roll the credits----------------*/
printf("\nMake ID - Version 1.0");
printf("\nMorse Code to JEDEC compiler");
printf("\ncopywrite (c) 1991 by Stephen R. Look  ka9szw\n\n");
/*--read in the text file to memory and echo it to the screen--*/
printf("\nFile read in:\n");
cntr=0;
while(ch!=EOF)
{
ch=getc(in);
if(ch=='\n') ch=32;
message[cntr]=toupper(ch);
printf("%c",message[cntr]);
if(message[cntr]>=0&message[cntr]<10) char_error();
if(message[cntr]==11) char_error();
if(message[cntr]>12&message[cntr]<26) char_error();
if(message[cntr]>26&message[cntr]<32) char_error();
if(message[cntr]==34) char_error();
if(message[cntr]>35&message[cntr]<44) char_error();
if(message[cntr]==64) char_error();
if(message[cntr]>90) char_error();
cntr++;
}
fclose(in);
/*--get code speed and calculate clock speed per ARRL Handbook-*/
printf("\n\ncode speed in wpm: ");
wpm=atoi(gets(c));
clk=wpm/1.2;
/*--use the lookup table to generate bit patterns--------*/
for(mcntr=0;message[mcntr]!=EOF;mcntr++)
{
for(refcntr=0;refcntr<=43;refcntr++)
{
if(reference[refcntr].key[0]==message[mcntr]) break;
}
if(message[mcntr]==35)
{
for(tone=0;tone!=(int)clk;tone++) strcat(bits,"1");
if(message[mcntr+1]!=35) strcat(bits,"000");
}
else if(message[mcntr]==33)
{
for(tone=0;tone!=(int)clk;tone++) strcat(bits,"0");
if(message[mcntr+1]!=33) strcat(bits,"000");
}
else
{
strcat(bits,reference[refcntr].morse);
strcat(bits,"00");
}
}
/*--get timing desired and calculate the number of bits needed--*/
bitcnt=0;
bitcnt=strlen(bits);
cntr=1;
ch=1;
while(1)
```

Program 1 continues

```
{
expandobits=(float)cntr*(float)bitcnt;
expandoclk=(float)cntr*clk;
time=(36288.-expandobits)/expandoclk;
if(expandobits>36288)
{
printf("\nChoose ID delay time - ");
printf("<number> or [Enter] to quit->");
gets(c);
num=atoi(c);
if(num<=0) exit(0);
else break;
}
time_frame(time,ptr);
printf("<%ld> %s\t",cntr,c);
if(ch%4==0) printf("\n");
ch++;
if(cntr%88==0)
{
printf("\nChoose ID delay time - ");
printf("<number> or [Enter] for more->");
gets(c);
num=atoi(c);
if(c[0]!=NULL) break;
}
cntr++;
}
/*----------------generate JEDEC file----------------*/
strcat(argv[1],".jed");
printf("\nCreating file: %s\n",argv[1]);
out=fopen(argv[1],"w");
ch=0;
for(cntr=0;bits[cntr]!=NULL;cntr++)
{
for(mcntr=0;mcntr<num;mcntr++)
{
dits[ch]=bits[cntr];
ch++;
}
}
fprintf(out,"ider JEDEC file produced by Mkid\n");
fprintf(out,"The 555 timer frequency needs to be %.1f Hz\n",(float)num*clk);
fprintf(out,"Resistor RA = %.1f Ohms",(14400000/((float)num*clk))-2000);
fprintf(out,"%c%c\n*\nL0\n",0x0a,0x02);
mcntr=0;
for(cntr=0;dits[cntr]!=NULL;cntr++)
{
fprintf(out,"%c",dits[cntr]);
if(mcntr==63)
{
fprintf(out,"\n");
mcntr=0;
}
else mcntr++;
}
fprintf(out,"*\n%c0000\n",0x03);
fclose(out);
printf("\nFile complete\n");
/*----------calculate timer frequency and device stats----------*/
printf("\nThe 555 timer frequency needs to be %.1f Hz",(float)num*clk);
printf("\nResistor RA = %.1f Ohms",(14400000/((float)num*clk))-2000);
time_frame((float)cntr/((float)num*clk),ptr);
printf("\nID will take %s to send",c);
time_frame((36288-cntr)/(num*clk),ptr);
printf(" with a delay of %s before it repeats\n",c);
printf("and uses %.1f%% of the chip capacity.\n",(float)cntr/36288*100);
exit(0);
}
```

Program 1 ends

Program 2.

```
/* jed2bin v1.0 - JEDEC to binary file convertor for stupid prom programmers.
Copyright (c) 1992 Stephen R. Look
This program is available for unlimited non-commercial
distribution. Modifications, bug reports and questions
(SASE please) may be sent to:
Stephen R. Look
727 W Wilson
Monticello, IL 61856
*/
#include <stdio.h>
/*---------------- main function ----------------*/
main()
{
FILE *in,*out;
int num,ch,cntr;
unsigned x;
char bucket[80];
char one[20],two[20];
printf("\nEnter input file name: ");
scanf("%s",one);
printf("\nEnter output file name: ");
scanf("%s",two);
in=fopen(one,"r");
out=fopen(two,"wb");
/*-------------roll the credits------------------*/
printf("\nJEDEC to Binary file converter - Version 1.0");
printf("\n      -a program of limited usefulness-");
printf("\n   copywrite (c) 1992 by Stephen R. Look\n\n");
/*-----read in the text file to memory and echo it to the screen----*/
printf("\nStripping header text:\n");
for(cntr=0;cntr<=5;cntr++)
{
fscanf(in,"%[^\n]\n",bucket);
printf("%s",bucket);
}
printf("\nStarting conversion:\n");
x=0;
while(1)
{
num=0;
for(cntr=0;cntr<=7;cntr++)
{
ch=getc(in);
if(ch==0x0a) ch=getc(in);
if(ch==0x0d) ch=getc(in);
if(ch==0x2a) break;
num>>=1;
x++;
if(ch=='1') num |= 128;
}
if(ch!=0x2a)
{
putc(num,out);
printf("\r%u ",x);
}
else
{
printf("\nFilling out file space with 0's:\n");
num=0;
while(x<36288)
{
putc(num,out);
printf("\r%u ",x);
x+=8;
}
exit(0);
}
}
}
```

Program 2 ends

Number 28 on your Feedback card

The "Hula Loop"

A stationary bidirectional hybrid three-element delta loop.

by Dean Frazier NH6XK

Conventional wisdom preaches that directors and reflectors must be on opposite sides of a driven antenna element to achieve best performance in one direction; hence the advent of the rotating beam antenna (Yagi-Uda, Moore Quad, etc.). But by its very definition, "conventional" wisdom may only describe what has worked in the past. It does not allow that something else may work as well, or better; now, or in the future. Conventional wisdom may lack vision. It may be incomplete.

The rules of my QTH environment (a planned community in Hawaii) preclude my erecting a tower or rotatable beam of any kind, yet out here in the ocean, at (about) 21 degrees north latitude, 158 degrees west longitude, I like to propagate mainly to the NE/SW. For several years I have used a commercial half-wave vertical to do just that, but the declining solar cycle has forced me to seek a bit more gain than produced by said vertical, a bit less noise on receive . . . but how to do it with a low launch angle, in at least two directions simultaneously?

Many solutions are well-known, such as using two driven radiators separated one half-wave and fed in phase; or spaced one quarter-wave, fed 180 degrees out of phase. I wanted a simpler solution because I wanted to avoid two driven elements and the requirement for proper electrical phasing.

Any bidirectional antenna I might erect would have to have more gain than my half-wave vertical. It would have to be put up in the trees of the forest to the NE behind my back fence. It would have to be fixed in location and non-rotatable. It would have to have sufficient gain both to the NE (to the mainland US and Europe) and SW (to ZL-VK and Africa) to make up for feedline losses resulting from a roughly 300-foot run from shack to antenna. Virtually loss-less open wire feeder was out of the question due to "visual impact," and the antenna had to "blend" into the forest scenery. The vertical loop was the obvious choice fed by low-loss high quality coax, and the delta loop, apex down, high current region "up," was chosen so I could take advantage of the simplicity of available (and minimum) supports . . . the trees.

Gain would be easily enhanced in one direction with a reflector "behind" the driven element (à la conventional wisdom), but how to get some signal "out the back" at the same time? Electronic switching, grounding out elements, multi-driven elements, and pausing were ruled out preemptorily. This had to be a "no-fuss," simple antenna.

So I again considered conventional wisdom as I poured over my textbooks in search of a solution. Then I closed the books, and closed my mind to conventional wisdom . . . and the solution was obvious: Put a reflector (or reflectors) on the west side of the driven element for gain to the east toward the US mainland, and put a director (or directors) also on the west for a boost to the west, (e.g. VK-ZL).

So, after much trial and error, working with as many as two reflectors and four directors nested within the reflector(s), and varying their lengths (perimeters) and their spacing from the driven element, the Hula Loop evolved. It's not very fancy or sophisticated, but its simple form should not be underestimated.

The final configuration survived the skepticism of many fellow hams. It is explained below and shown in Figure 1. First, let me point out that prior to the utilization of the Hula Loop, the best I could do to the East Coast of America was 5/6 with the 3 dBd gain half-wave vertical, whereas now I consistently re-

Photo A. The Hula Loop driven element at its feed point. Note the 1:1 balun.

Photo B. The bottom apex of the Hula Loop's diflector. Note that nylon cord is used to secure the antenna.

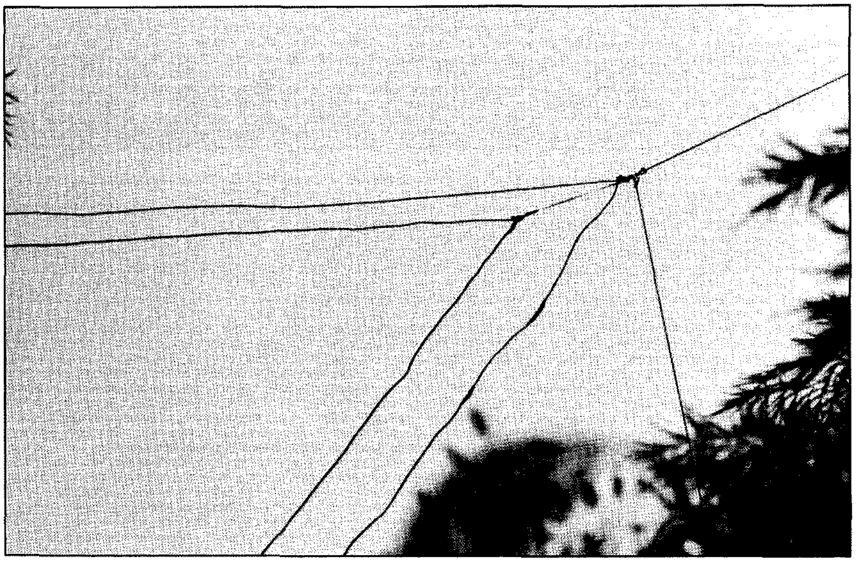


Photo C. Another view of the Hula Loop's construction. The antenna blends into the scenery when viewed from a distance.

ceive 5/9 or 5/9+ reports. To Australia and New Zealand, the vertical consistently beat my original single-element and eventual two-element delta loop, but now it's the other way around by 2 S-units. Short path to South Africa over Antarctica, I'd get 5/3 on the vertical and 5/2 on the conventional two-element delta loop, and now it's more like 5/7-5/8 on the three-element loop. To Europe over the North Pole, it used to be 5/5-5/6 with the vertical, and now it's 5/8-5/9-5/9+, even as the solar cycle declines, with the hybrid delta loop.

I can still communicate to Asia and South America with the vertical and a Loop Skywire, but not as well as the Hula Loop does to the northeast and southwest, from Hawaii.

The Hula Loop's Design

The Hula Loop consists of a driven delta loop, apex down, behind which is a passive reflector 3% longer around than the driven, in which is nested a director cut 3% shorter than the driven. The reflector-director combination (which I call the Diflector) is spaced 0.16 wave (about 8'8" on 17 meters) from the driven element. This wide spacing results in the feed point impedance being in the 80-100 ohm range, as usual for a full-wave single-element loop, so feeding with 50 ohm coax (Belden 9913) terminating in an odd multiple of 75 ohm coax is appropriate ($\sqrt{50 \times 100}$ = 71 ohms). Moving the diflector towards the driven element would eventually bring down the feed point impedance to 50 ohms at some particular spacing, allowing a "straight infeed" with 50 ohms, but the forest in which the loop is erected does not allow this luxury.

After cutting the driven element by using the formula (1005/f MHz = length in feet) and forming an equilateral triangle with the feed point at the bottom apex, and after having put the element "in situo," I then tuned this driven element to resonance, then measured its final length (or perimeter). Then I cut and placed the diflector by this formula: If the final tuned length of wire in the driven

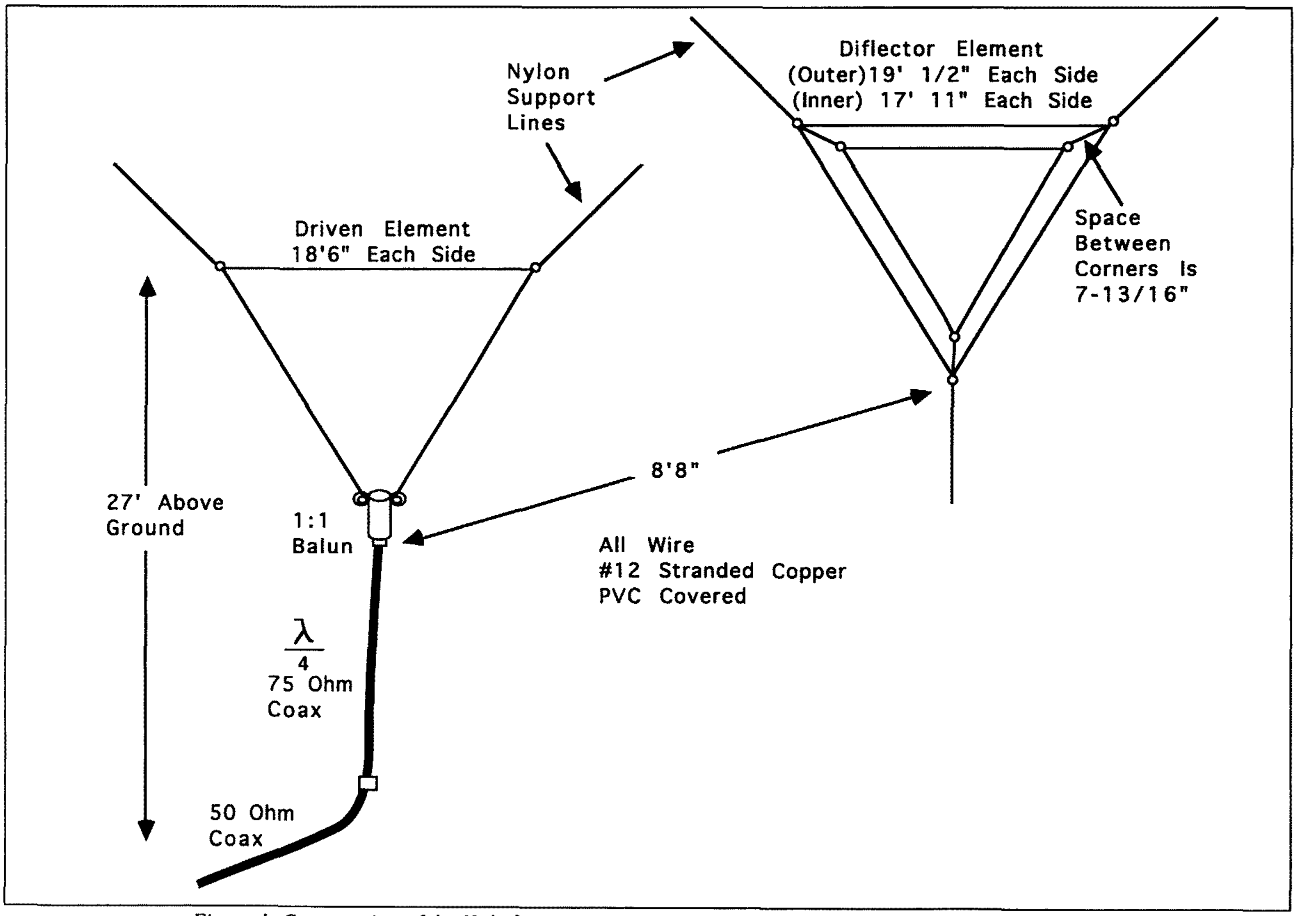


Figure 1. Construction of the Hula Loop, an 18 MHz bidirectional three-element delta loop antenna.

element comes out to be "L" feet, then cut the reflector according to 1.03 x L, and cut the director according to 0.97 x L. Both the reflector and director are then shaped into equilateral triangles, and the director is nested into the reflector using non-conductive material (nylon line) at the corners.

The reflector and director are closed parasitic loops; the driven element is open at its bottom. One end of the wire connects to one side of a 1:1 current balun, the other wire end to the other side of the balun. The quarter wave of 75 ohm coax then connects (screws) to the base of the balun, and its other end joins to 50 ohm coax (thence back to the shack) via a barrel connector. The balun is not a necessity, but if not used, I suggest that you wind and tape about six turns of coax (roughly six inches in diameter), directly at the feed point to act as an air-choke to RF. This will help to decouple the coax braid from the antenna to aid canceling RFI-TVI causing currents on the coax braid. Whatever method of putting power into the antenna is used, seal all exposed conductors from the elements. I use #12 stranded copper wire, PVC covered, for the driven element, director, and reflector. Be advised that the beginning length around the driven element (1005/f MHz = feet) probably won't work out quite right due to the detuning effects of not only the diflector (a small effect at 0.16-wave spacing), but primarily due to the particular final antenna environment . . . proximity to metal, wood, etc., and due to variation in length from the formula (1005/f) because of different wire gauges.

The driven element and the diflector are hung vertically, using nylon line attached to the upper corners. The driven feed point and the bottom apex of the diflector are prevented from swaying in the wind with light nylon line tied off to low bushes or ground stakes. As the figure shows, the Hula Loop is simply constructed.

Results

On-the-air signal reports indicated the following: To the NE (US mainland and Europe) signal reports are about the same as when the loop was configured as a conventional two-element delta loop (driven and reflector), and 3 to 4 S-units stronger than the commercial half-wave vertical (very nearly the same coax line loss at 18.113 MHz, to both antennas). To the SW (VK-ZL and Africa), the conventional half-wave vertical beat the two-element delta loop by 1 to 1-1/2 S-units, but with the diflector in place, the three-element Hula Loop is better than the vertical by 2 S-units.

I suspect I may have "lost" 1/2 to 1 dB to the NE with the Hula Loop, compared to a two-element delta loop. I now have a narrower half-power beamwidth, but the gain "out the back" is startling.

In any event, with the Hula Loop I now put more signal both NE and SW than ever before with a 3 dBd half-wave vertical or with a conventional two-element delta loop.

All work was performed on the 17 meter band, at 350 watts.

I encourage others to experiment with directors nested within reflectors to see the effect on forward and rearward gain, compared to that of a conventional two-element loop antenna, keeping all antennas at the same height over the same ground. The flat-top of my Hula Loop is at 27 feet which puts the centroid of the triangles at about a third wave . . . raising the top to perhaps 35 feet would more nearly place the centroids near half-wave, with a resultant lowering of launch angle, but such may not be possible in the forest within which I work. In any experimentation with the diflector concept, however, as many variables must be eliminated from the problem. Conditions should be made the same for both the antenna under experimentation and with the control antenna, to allow any differences between the test and control antennas to become apparent.

Special thanks to Ron Turner KD6FZ, Del Mar, California, and Tony Thomas ZL2ANT and Jock Campbell ZL1ACW of North Island, New Zealand, for their help in extensive on-the-air testing of the Hula Loop against the two-element delta loop and the commercial half-wave vertical.

The Quad Charger

A constant current NiCd charger.

by Marion D. Kitchens K4GOK

Every ham I know uses NiCd batteries at one time or another. "Nicads" are nice, but they pose the never-ending challenge of keeping a charged set on hand. This often requires keeping a number of various battery packs or individual cells in ready-to-use condition. Most battery chargers are designed for one particular size individual cell, or for particular battery packs. It can be agonizing to have the wrong battery pack on the charger while the one needed is yet to be charged.

Finding the correct charger or setting a variable voltage charger to the proper voltage is an unnecessary hassle. A more useful charger would allow for charging several battery packs or individual cells simultaneously, and would accommodate battery pack voltages ranging from one cell up to eight or more cells; that is, 1.25 volts up to about 12 volts.

The Quad Charger described here was designed and built to take the hassle out of using NiCds. The unit as described provides charge rates for most common NiCds, and provides several trickle charge rates too. Since this unit provides a constant charge current, the output voltage automatically adjusts to that necessary for the battery or pack being charged. NiCds are charged based on the amount of current and the duration (time) that current is injected into the NiCd, so a constant current is a good way to charge them.

The Quad Charger will charge up to four different NiCd cells or battery packs at the same time. It is easy to build via the PCB layout provided, or via point-to-point wiring on perf board. The circuit is straightforward and without gimmicks or tricky adjustments.

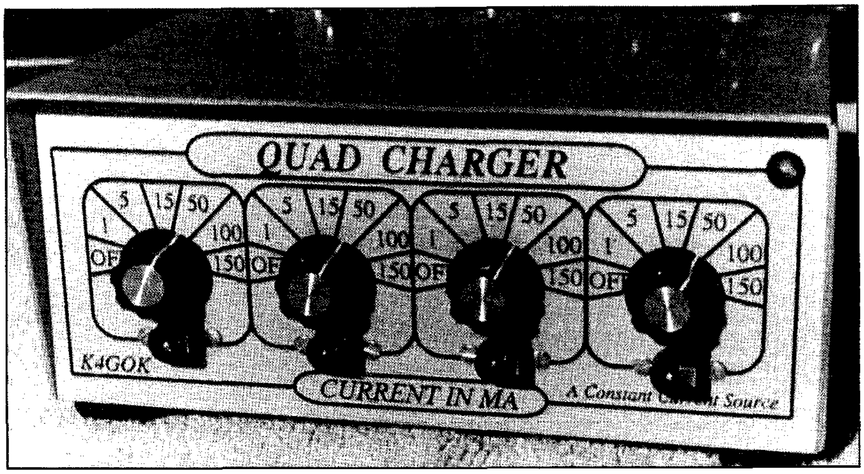


Photo A. Finished Quad Charger.

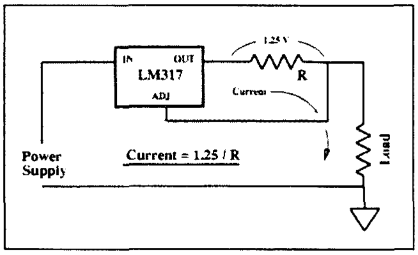


Figure 1. LM317 as a constant current source.

All parts are readily available from suppliers such as Digi-Key.

Theory of Operation

The versatile LM317 voltage regulator is readily usable as a constant current regulator by simply connecting the IC to a resistor. The LM317 is designed to maintain 1.25 volts between its output pin and its "adjust" pin. The electronics within the IC will react to assure that this condition exists at all times (as long as it is physically possible). That means you can put a resistor between those two pins and the LM317 will deliver a constant current through the resistor. The current will then be regulated by the IC in accord with Ohm's Law. All we have to do is connect the desired load, in this case the battery or pack to be charged, in series with this constant current.

Examine Figure 1. The voltage from the supply is applied through the LM317, through the resistor, and to the load. The internal circuitry of the LM317 maintains a constant 1.25 volts across the resistor. If the resistor is 125 ohms, the current will be 10 mA. If it is 12.5 ohms, the current will be 100 mA. Since the current in a series circuit is the same in all parts of the circuit, the load will also have a regulated, constant current. The value of that current will be determined by the value of the resistor.

Note that the current is independent of the load. The current through a single 1.25 volt AA cell will be the same as that through a 9 volt battery pack. And to the obvious question, yes, it is the same for a zero ohm load, i.e. a short circuit. (A constant current supply

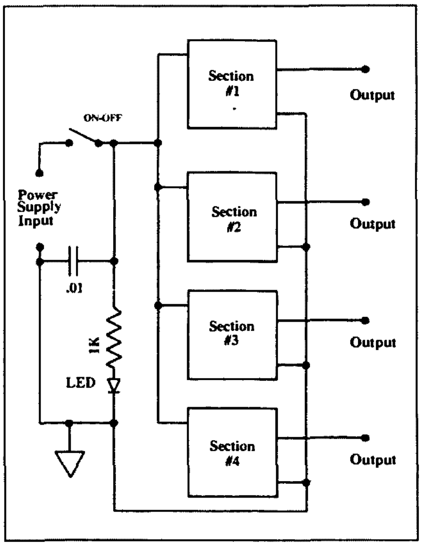


Figure 2. Quad Charger system schematic.

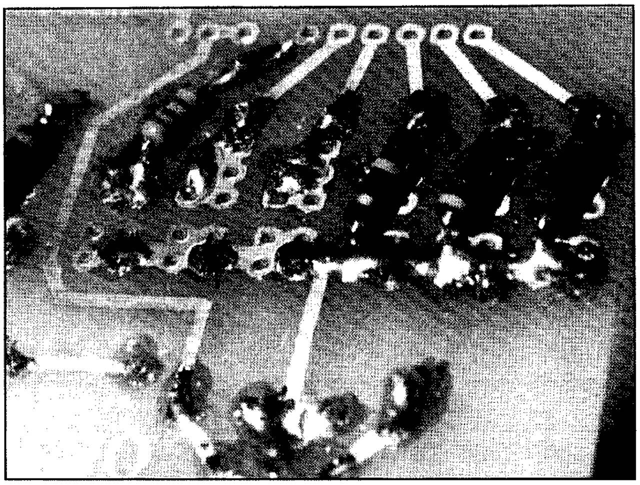


Photo B. Resistors on foil side of PCB.

Photo C. LM317 mounting, showing off-set arrangement.

is pretty neat because a short across the output is perfectly acceptable and causes no harm!)

The LM317 requires a certain amount of current in and of itself to operate. This is identified as the "quiescent" current in the literature. The quiescent current flows from the supply through the LM317, out of the "adjust" pin, and into the load. Its value is typically around 0.35 mA, and can be neglected in most cases. If you want exact currents, however, you will have to account for that current in any analysis or adjustment of the circuit. Using pots in the circuit allows for exact setting of the current, including effects of the LM317 quiescent current. Because of the quiescent current, the OFF position of the rotary switches will result in a small current in any connected load.

The LM317s must be able to dissipate the heat generated when they are used in the Quad Charger. The thermal "design point" is reached when operating at the maximum supply voltage and maximum output current, with the output shorted to ground. Assuming a 13.8 volt supply and 150 mA, the maximum power the LM317 must dissipate as heat is just under 2 watts. It requires a heat sink to do that without overheating.

Figure 2 shows the system schematic of the Quad Charger. Figure 3 shows the detailed schematic of one of the four identical charger sections.

Construction

The Quad Charger is basically a simple circuit, but with lots of connections. PCB construction is recommended because of the number of solder connections involved; however, point-to-point wiring on perf board is quite feasible. See Figure 4 for the PCB layout and parts placement. The parts placement drawing shows where the parts are located on the PCB. The pots can be replaced with fixed resistors if exact currents are not required—see "Alternate Construction" below.

It is good practice to build one portion of the Quad Charger at a time. Install the pots first. Trimmer pots R4, R5, and R6 have fixed resistors in parallel. These resistors are mounted on the solder side of the PCB. Install the fixed resistors after installing the pots.

Note the orientation of the four diodes, and install them correctly. Observe polarity when installing the eight tantalum capacitors. Don't forget to install the jumper wire.

Make all the connections to the output jacks and rotary control switches. If using coaxial output jacks, make sure you match the jacks and plugs. Many coaxial jacks and plugs look alike but are not compatible. Note that there is no connection to the first (OFF) position of the control switches. The

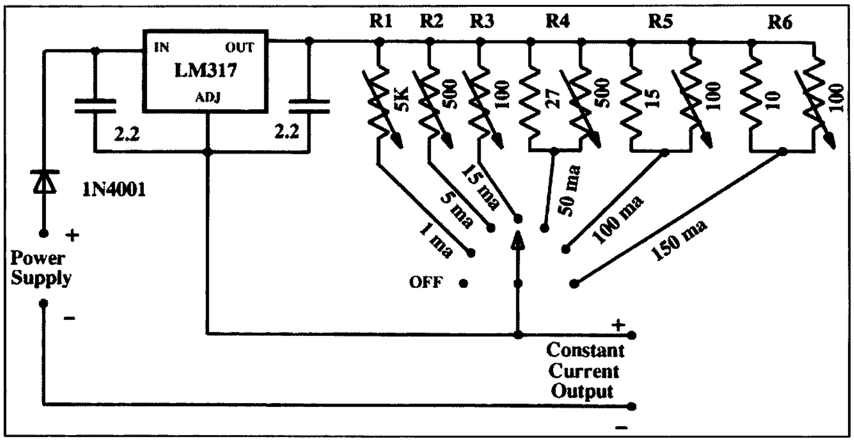


Figure 3. Quad Charger schematic (one of four identical sections).

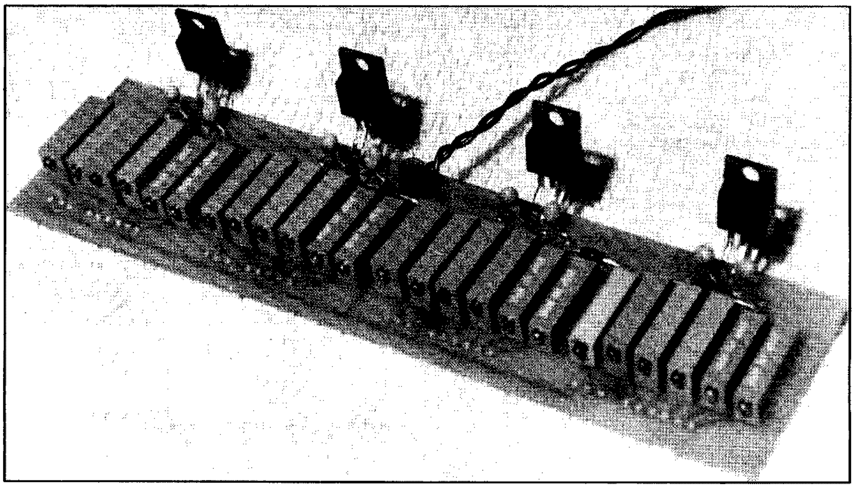


Photo D. Assembled board.

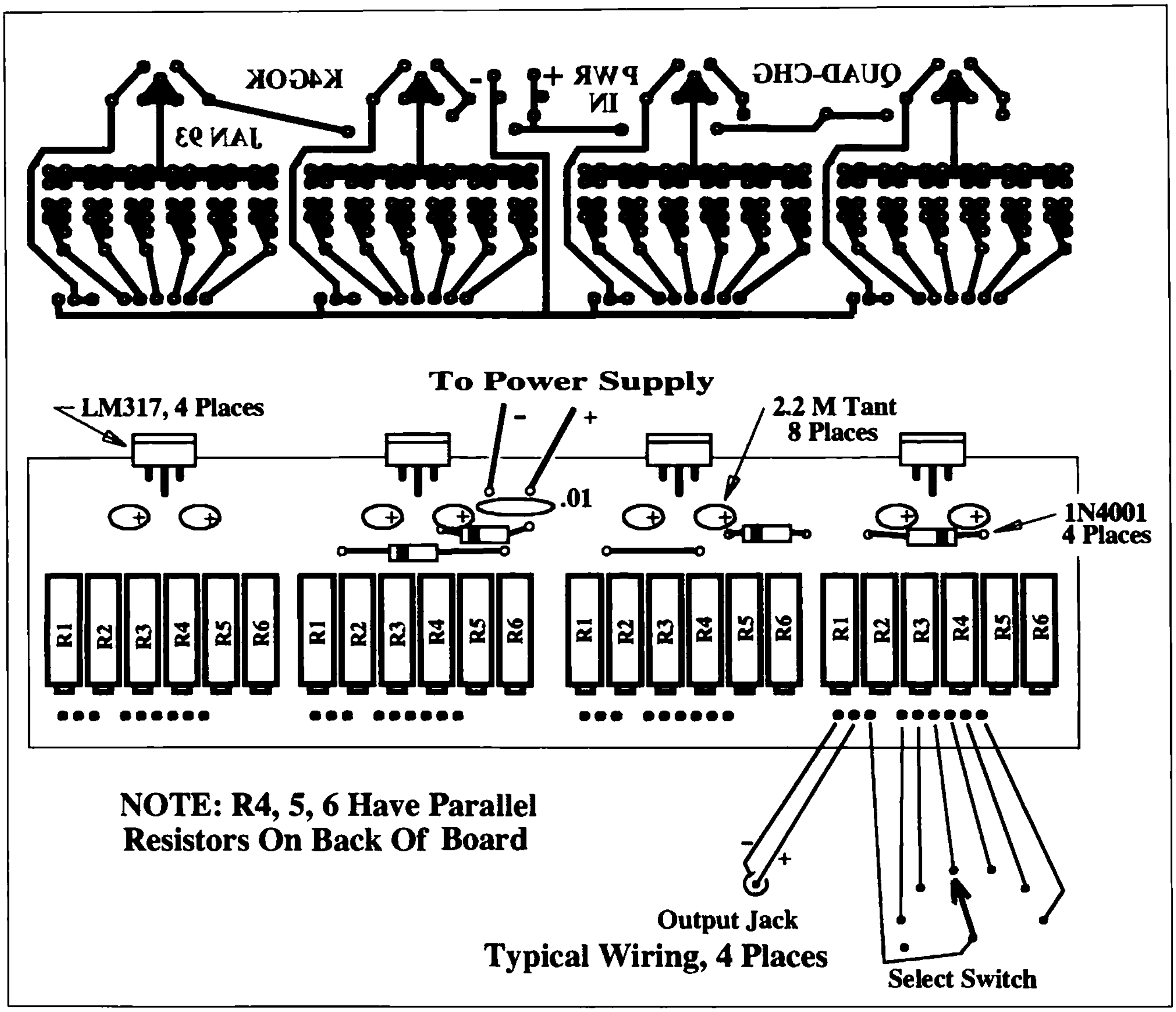


Figure 4. PCB layout (view from the component side), and parts placement.

OFF lug on these switches should therefore have nothing connected.

Mount the LM317s to the board in a vertical position, orienting them as shown in the photos and parts placement drawing. Bend the LM317 leads so that the mounting tabs are offset about 1/8" beyond the edge of the PCB. The LM317s are used to mount the PCB inside the cabinet. Solder the LM317s to the PCB, mount the LM317's to the heat sink, and the PCB requires no further mounting. A completed circuit board is shown in Photo D.

The Parts List describes the components used in the Quad Charger. It is important to put the LM317 ICs on a good heat sink (Photo E). Be sure to use insulators between the LM317s and the heat sink. The LM317 mounting tabs must not make electrical connection to the heat sink or to each other. If a metal enclosure is used, the rear panel might make a suitable heat sink. Photo E shows the heat sink I used. It is considerably more than adequate.

Alternate Construction

The recommended construction for the Quad Charger is with pots for adjusting the charge currents. However, since there is nothing critical about charging NiCds with an exact current, combinations of fixed resistors can be substituted for the pots. Table 1 shows several combinations of fixed parallel resistors that can be used. Any pair of resistors from column A, B, or C can be used. Select a pair that you have readily available. The chart shows, for example, three possible combinations (12/22, 15/20, 18/15) for R6. [The notation "12/22" means a 12 ohm resistor in parallel with a 22 ohm resistor.] Any of the pairs shown for R6 will produce approximately 150 mA charge current. A current variation of +/-10% from that recommended will not be significant in charging NiCds.

Because the quiescent current mentioned above is a substantial part of 1 mA and varies between individual LM317s, a bit of trial and error may be required to get a suitable set of fixed resistors at R1. But since this is a trickle charge setting, don't worry about obtaining an exact current value.

There is nothing special about having four sections to the Quad Charger. Any number of charging sections can be constructed by adding or deleting sections. Typically, a builder will underestimate the need, so build more than it now appears you will use. This is a highly useful circuit; save yourself some hassle and don't underestimate your needs.

Supply Voltage

Some notes are in order about the power supply to be used with the Quad Charger. Obviously a NiCd pack can't be charged from a supply of lesser voltage. Further, the LM317 requires about 3 volts across its terminals for proper operation. So the minimum supply voltage is that of the fully-charged NiCd, plus 3 or more volts. There is also an upper limit of 37 volts dictated by the LM317. The LM317 is designed to handle 1.5 amps of current, so that is not a prob-

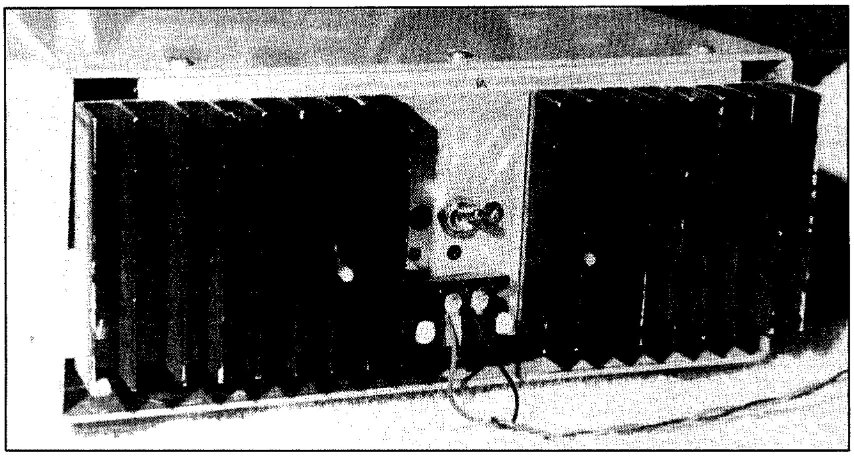


Photo E. Heat sink used on Quad Charger.

lem in the Quad Charger circuit.

The supply voltage will be a determining factor in the size of the necessary heat sink. The lower the supply voltage the smaller the required heat sink, and vice versa.

Checkout and Adjustment

After soldering all the components in place, carefully check for solder bridges and open connections. Check carefully at the PCB where the connections to the switches are made. Remove any solder bridges before proceeding.

Set all the pots near their mid-range position. The exact setting is not important, but the pots should not be at zero ohms. Select the 1 mA position for all the control switches. Remove anything connected to the output jacks. The LM317s should be mounted to their heat sink to prevent excessive heating during checkout. Connect a 12 volt power supply to the Quad Charger through your mA meter. The Quad Charger (without the LED connected) should draw no current. Note that the LED will draw about 10 mA if used. Check for bad connections if the total current is beyond that for the LED.

Connect a 100 ohm resistor in series with your mA meter and plug it in the output jack of the first charger section, then immediately note the meter reading. It should not be more than a few mA. Adjust R1 until the meter reads 1 mA. Switch to the 5 mA position and adjust R2 for a 5 mA reading on the meter. Adjust R3 and R4 for 15 mA and 50 mA respectively at the appropriate switch positions. With the switch set in the 50 mA position, short across the 100 ohm resistor to verify that the current remains at 50 mA with and without the resistor in the circuit. Remove the 100 ohm resistor, and adjust R5 and R6 for 100 mA and 150 mA with the switch in the respective positions.

Repeat this procedure for each of the remaining three sections.

Check the LM317s for any signs of excessive heating during and after the above adjustments; they should stay cool enough to touch comfortably. As a final check of the heat sink size, put a short across all four output jacks and set all four switches for 150 mA. Check the temperature of the LM317s. If they get too hot to touch comfortably, a more capable heat sink is required. A reasonable way to estimate temperature is to remember that your body (finger) temperature is about 98 degrees F, and that 105-110 degrees feels warm to the touch. A temperature of about 120-130 degrees is too hot for me to touch comfortably for very long.

When your Quad Charger checks out OK as described above, it is ready to use!

Conclusion

The Quad Charger has been in use at this QTH for a couple of years. It has proven highly useful, and is in daily use. It saves a good bit of hassle and concern, and provides a set of charged NiCds any time they are needed.

Table 1. Some Useful Parallel Fixed Resistor Values (All 1/4 Watt Resistors)

Charge Current	Resistor	Parallel Combinations A	B	C
1 mA	R1	2.2k	2.7k/6.8k	3.3k/4.7k
5 mA	R2	270	330/1.5k	470/680
15 mA	R3	110/560	150/200	150/200
50 mA	R4	27/330	33/100	47/51
100 mA	R5	12	15/68	22/27
150 mA	R6	8.2	10/47	15/18

"XX/YY" means parallel a resistor of XX ohms with one of YY ohms. A single number in a column means use a single resistor of that value. Select any combination from column A,B, or C.

Parts List (For One of Four Identical Sections)

IC-1	LM317T	
C1, C2	2.2 μF tant.	
D1	1N4001 or similar	
R1	5k pot	Note: All pots are Bourns series 3006P or similar
R2	500 ohm pot	
R3	100 ohm pot	
R4	500 ohm pot paralleled with 27 ohm resistor	
R5	100 ohm pot paralleled with 15 ohm resistor	
R6	100 ohm pot paralleled with 10 ohm resistor	

Output jack and plug of builder's choice
Rotary switch, 12 positions, one pole (seven positions used)
Single items needed for the entire Quad Charger:
- ON/OFF switch, SPST
- LED and 1k resistor
- PCB or perf board, cabinet, etc.

Drilled and etched PC boards are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118, for $6.50 plus $1.50 S&H.
See Table 1 for alternate construction parts.

Rules of Thumb for Charging NiCds

The recommended charge current is usually indicated on the pack or cell in question, along with the recommended charge time. If not, there are some reasonable rules of thumb for charging a NiCd. Charge a NiCd (pack or individual cell) at a rate in mA that is equal to 1/10 the value of the NiCd rating in mA/hr. For example, a 500 mA/hr. NiCd should be charged at 50 mA. NiCds require a total charge energy input equal about 1.5 times their mA/hr. rating. That means a NiCd should be charged at the "rule of thumb" rate for 15 hours. To recap, a NiCd should be charged at 1/10 its mA/hr. value for 15 hours.

Most AA size NiCds should be charged at 50 mA for 12 to 15 hours. Most C size NiCds, and many D size NiCds, should be charged for 18-20 hours at 100 mA. Or charge the C and D size NiCds for 12-15 hours at 150 mA. A 9 volt "transistor" size NiCd should typically be charged at 10-15 mA for 12-15 hours.

I trickle charge AA size NiCds at 1 mA and C and D size NiCds at 5 mA.

Number 8 on your Feedback card

73 Review

by Joseph J. Carr K4IPV

EASY-PC Printed Circuit Layout Software

Want to get into computer-aided design (CAD)?

Number One Systems, Ltd.
c/o Ms. Sandy Bell
1795 Granger Avenue
Los Altos CA 94024
Telephone: (415) 968-9306
Price Class: $195

For more than a quarter of a century (!) I've been writing about ham radio and hobby electronics. Over that time I've drawn about seventy kazillion schematics, laid out a couple score or two of printed circuits, and used up about 40 tons of those green "engineer's sketch paper pads" in the process. Now that I own a killer 486 computer, I decided to buy several software packages to make my technical writing easier and to help me do the schematics and PCB layouts (especially since one of my book publishers occasionally uses my original artwork . . . which isn't all that good).

I bought several software packages recently, but the one that I like a lot for laying out printed circuit boards is Easy-PC from Number One Systems, Ltd. (Harding Way, St. Ives, Huntington, Cambs., England, PE17 4WR. By the time this is published you will be able to contact the company via Ms. Sandy Bell, 1795 Granger Avenue, Los Altos, CA 94024; telephone 415-968-9306), at a cost of $195.

Features

EASY-PC is a very capable CAD program that rivals many professional packages in its built-in features. Indeed, although a professional version is available at extra cost, a large number of commercial or professional users will be able to use the EASY-PC version that I tested. It certainly meets my needs quite well.

EASY-PC will accommodate PCB sizes up to 17" x 17" (43 cm x 43 cm), and permits up to 1,500 ICs per board. It also allows up to 5,000 printed tracks with up to 12,000 track segments, and 4,000 connection pads per board. Those numbers add up to some pretty large boards, especially for amateur radio projects. The tracks can be laid down in widths from 0.002 to more than 0.5 inches (see Figure 1), while pads are available in the same sizes (up to 16 pad sizes are defined—see Figure 2A). There are also a number of PCB pad variants available, and these are shown in Figure 2B. There is a symbol set (Figure 3 shows a small sample) that can also be used on the PCB. The symbols are used to establish spacings between parts, and to create the top-of-board silk-screen pattern.

Most amateurs are familiar with single-layer PCBs (i.e. those with printed wiring on the bottom side) and double-sided PCBs (i.e. those with wiring on both sides of the card). It is frequently the case that the top layer is used for ground planes and/or DC distribution, along with the silk-screened component layouts. Advanced PCBs are multi-layered, and EASY-PC allows up to 10-layer designs. Eight of the layers are used for pad and track layouts, while the top layer (denoted "layer 0") is used for component overlay symbols and text information. The bottom layer ("layer 9") is typically used for text. One interesting feature of this layer is that it can be flipped to mirror image so that the text letters and numbers will appear correctly in the manufactured board.

When viewed on the screen of your computer's color monitor, the various layers can be rendered in different colors. Pads appear as white on a black background, while tracks are in red. When you go to a different layer, then a third color can be selected. That approach allows you to see the entire circuit, while keeping the various layers separated in your mind. When printing out the design on paper, either all tracks at once or just the layers of interest can be printed.

Getting Started

EASY-PC comes with 3.5" diskettes (5.25" on request), and installs easily. No one who has ever installed a modern program into a personal computer will have even the slightest difficulty in installing EASY-PC. If you do have a problem, the instructions are given in clear language in the manual, in any event.

The manual includes a tutorial that can take an hour or two to complete. Like many an impatient fellow, I attempted to skip over the tutorial and jump right into the program. Dumb. Take the time to work your way through the tutorial. It shows you in great detail how to work the program, and once you've gained that bit of empowerment a lot of other tasks can be figured out.

A mouse is highly recommended for EASY-PC, but the arrow keys will move the cursor for those who don't have a mouse. Operations within the program are selected from menus on the screen. When you first initialize the program at each session you will get a main menu that asks whether you want to design a PCB layout, design a schematic, or return to DOS. Once an option is selected the screen changes, and three small squares appear along the top of the monitor

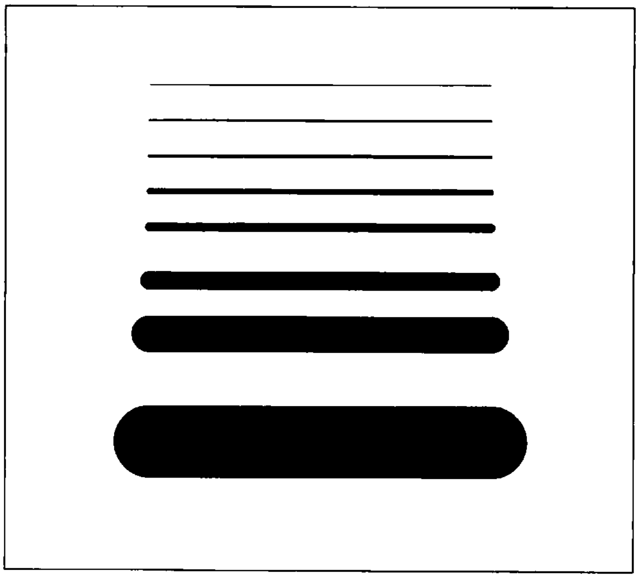


Figure 1. Track widths available on EASY-PC.

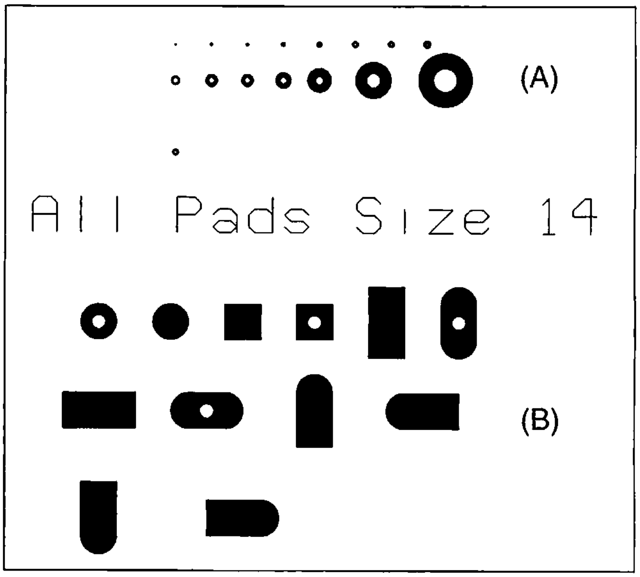


Figure 2. A) Pad widths available on EASY-PC; B) Pad variants available.

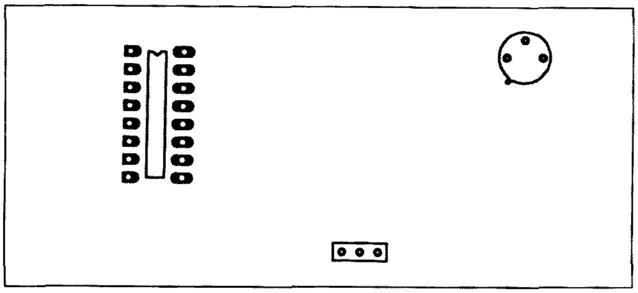


Figure 3. Symbols.

screen. Each of these squares is a trigger that turns on a pull-down menu (Left, Center and Right).

When you first enter the PCB layout screen, the background is black and there will be a white square in the center, taking up about a third of the screen area; the menu trigger boxes are along the top of the screen. This white square represents the 17" X 17" area of the largest size board that the program will accommodate. It is far too large an area to work in effectively, so you can use the Right Menu to find a "Zoom" function. If you click on the Zoom function, and then move the cursor to a point within the white square, the program magnifies the region so that the cursor-selected point is in the middle of the screen.

There are seven levels of magnification (ZM1 through ZM7), and these can be selected by pressing a number key immediately after clicking the mouse to position the cursor. For example, from the first level, ZM7, a single zoom operation takes you to level ZM6, but if immediately after arriving at ZM6 you press "3" the screen jumps to ZM3. The highest level, ZM7, is the initial opening screen and represents the 17" X 17" total area, with each lesser number (ZM1-ZM6) representing a magnified view of a smaller area. Level ZM4 is close to life-sized, but is not exact. I found that level ZM3 was the most congenial to work in for the kind of circuits that I do. If you design a very sparse board, then a lesser magnification can be accommodated (e.g. ZM4/ZM5), but if a really dense board is being designed, ZM1 or ZM2 might be appropriate. The adjacent levels appear to have a relationship of about 2:1 to each other.

On all zoom levels other than ZM7 there is a "Grid" option that can be selected from the Right Menu. This option is highly recommended. It overlays a grid of dots to permit you to locate components properly and measure lengths. In the ZM6 level the dots represent distances of 1" each, while in my favorite ZM3 layer a 0.100" dot grid appears. Note that the 0.100 spacing is a standard, especially on digital components. The pins on a DIP IC package, for example, are 0.100" apart.

When working at a magnified level (below ZM7), even a moderate-sized board might not fit entirely onto the screen at one time. EASY-PC accommodates this difficulty quite nicely by having a "Pan" option selectable from the Right Menu. Select Pan, and then place the cursor at the spot on the PCB that you want to appear in the center of the screen. On larger boards, a move from one extreme edge to the other may take a couple of successive selections in the higher magnification levels of zoom. This problem can be rectified by using the "Unzoom" feature to temporarily go to a higher level. When you again Zoom into the working level, the selected area will be centered on the screen. There seems to be no difficulty in zooming and unzooming.

I found the ability to pan and zip between zoom levels very useful for initially laying out the board. In one application I knew I needed a board that

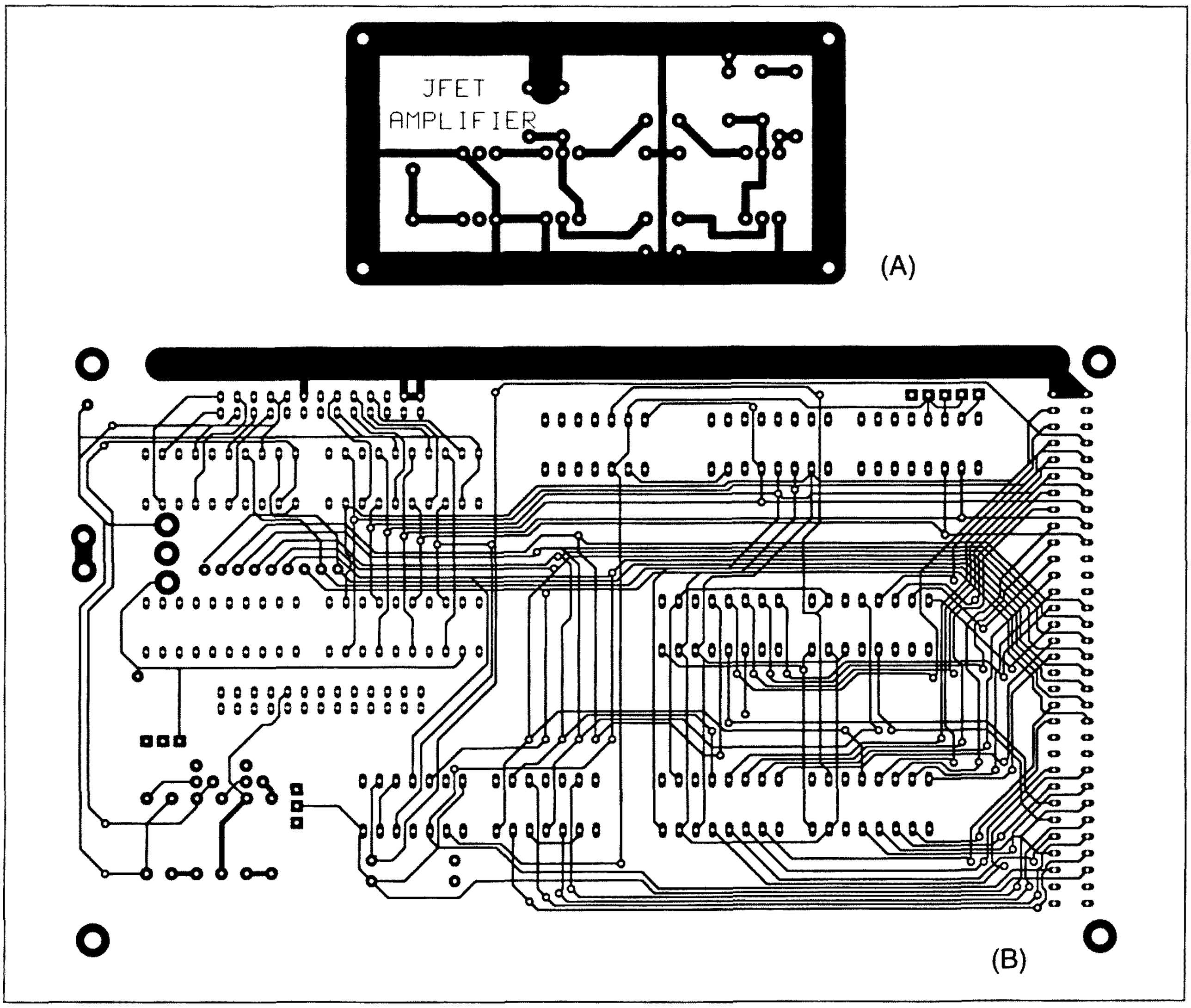


Figure 4. A) JFET preamplifier PCB I designed; B) Complex board from the tutorial package of EASY-PC.

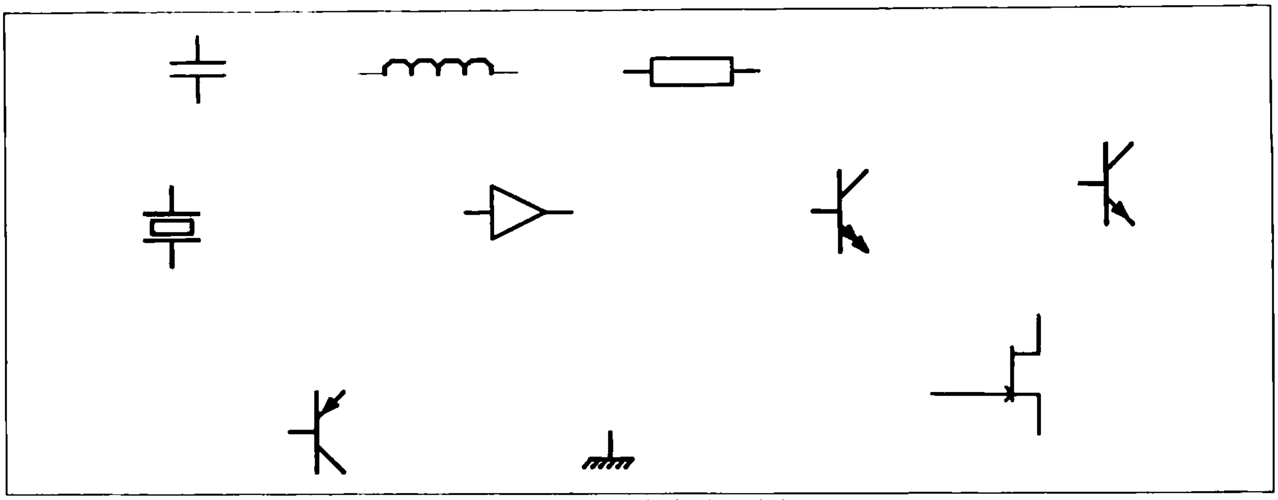


Figure 5. Schematic circuit symbols.

was 2" X 3" because it had to fit into an existing space. By selecting ZM6, turning on the 1" grid pattern, I was able to lay out the ground tracks around the edge of the board. That little job not only ensured that the tracks would be there when needed, but also defined the limits where I could work when the display was zoomed back to ZM3.

Figure 4A shows a printed circuit layout that I designed for a push-pull JFET RF amplifier. This design took me about an hour because it was the first time I tried anything other than the tutorial. I am quite pleased with the result, and a redesign (made to accommodate a different RF transformer component) took only 20 minutes. As I gain skill, I expect the layout times to be reduced considerably. Like any skill, PCB layout is sensitive to doing it for a while. Figure 4B shows a complex, multilayer PCB that is part of the tutorial package in EASY-PC. In this printout, all layers are shown at once. The printing menu will permit each layer to be printed separately.

Printout

Having a PCB layout on a computer screen is not terribly useful unless it can be transferred to a real board. EASY-PC allows the design to be printed out on either 9-pin or 24-pin "IBM graphics compatible" printers (which includes about all of them sold today), a plotter (which few amateurs have available), or laser or ink-jet printer. Specifically supported are laser (etc.) printers that will respond to the Hewlett-Packard Laserjet II and Laserjet III formats. My Laserjet III had no difficulty handling the graphics, even though it contains only about half the memory that the machine will hold.

Laser printer printouts are done through a utility

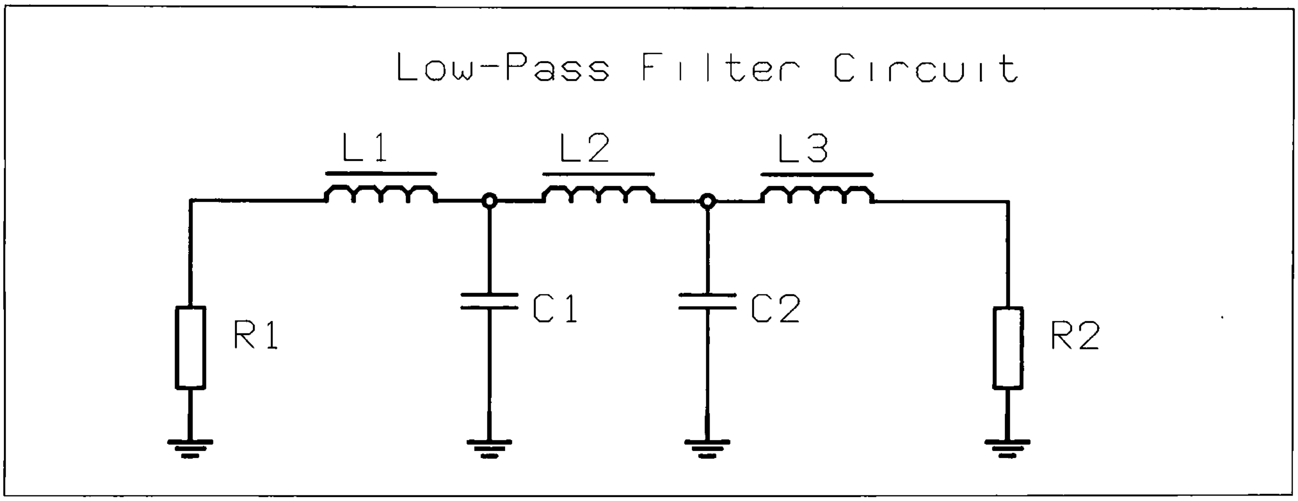


Figure 6. Sample schematic made using EASY-PC.

program that comes with EASY-PC: EASY-LASE. To print a layout, quit EASY-PC and return to the DOS prompt and type in "EASYLASE." The printing program screen will pop up with a number of selections. Something to note for USA purchasers is that British paper sizes are different from American paper sizes, so first off change the paper size to 8.5 x 11, or 8.5 x 14, depending on which you use. My version of EASY-PC came set to something called "A4" paper, which I assume is some British or European standard paper size.

Another trick I learned is to always press "K" to center the trace, although for your use this may not be needed. Otherwise, the trace will appear along the upper right-hand edge of the paper. This positioning would be OK if you are cutting it out and using it directly, but it doesn't easily accommodate the size needed for the printed circuit contact exposure frame that came with a PCB-making kit I bought.

Schematic Diagrams

One of the other design layout capabilities that EASY-PC offers is a schematic drawing option. You can draw some rather complex schematic drawings, and then print them out on a laser printer that makes them look "just like downtown." A symbols library is available, containing the most commonly used symbols. In addition, the program allows you to design your own symbols and add them to the library. Each symbol is given a file name that is used to call it into play. For example, "R" produces a resistor on the screen, while "L" and "C" invoke inductor and capacitor symbols, respectively; "XTAL" is the crystal symbol. Figure 5 shows some of the EASY-PC symbols that are available. American

readers will be mildly disconcerted by the European look of some of the symbols. For example, in Figure 5 the rectangle with axial leads is what you get when a resistor ("R") is selected. Figure 6 shows a low-pass filter schematic done on EASY-PC.

Suggestions

There are no serious criticisms to make regarding EASY-PC. I found it quite capable, and easy to learn. Even a computer dyslexic will find EASY-PC congenial, and for the Nintendo generation of users, hey!, it's duck soup. But there are a few nit noids to pick on, and since a reviewer is not doing his job if nothing naughty is reported . . . well, you get the picture. I have to grouse about something, or I'll lose my "Curmudgeon License."

Nit-Noid #1. The manual is a bit short in some of the instructions on how to do certain options. This appears to be the result of some well-qualified user forgetting us poor slobs who never saw the program before. One problem that I had was in the need to "fix" the location of pads and tracks. When you select "New Pad" from the Left Menu, and then move the cursor to where the pad is to be located, clicking the left mouse button places the pad at that point. However, moving the mouse to another location and then clicking again causes the pad to suddenly jump to the new location. This is a great feature for editing and correcting mistakes, but it's terribly disconcerting at first. What seemed to be poorly described is the need for a second operation to fix the location: Click the right mouse button. It is described in the manual, but I failed to pick it up first go around.

Nit-noid #2. The symbols libraries in both the PCB and schematic selections reflect a digital view of the world—lots of digital ICs, but only a few linear devices. While there are standard transistor symbols in both PCB and schematic portions, one does not see RF transistors or RF and other analog integrated circuits (e.g. the Signetics NE-602 device or the MC-1350P device). I would like to see both in future libraries.

Recommendations for Improvement

It appears the Number One Systems, Ltd. is committed to continuously improving their product (Dr. Deming and the Total Quality Management crowd will be delighted to hear), so I hope they will take into consideration some improvements.

First, figure out how Heathkit wrote kit-building manuals, and then use the knowledge as a model on how to rewrite the EASY-PC manual. This is not a slam on Number One Systems in particular, but reflects the fact that nearly the entire software industry seems to use qualified experts to test drive their "beta" versions prior to releasing to the public.

Second, now that they are moving into the USA/Canada market, create a set of libraries that reflect the symbols used in North America. Keep the European standard symbols, but add, even at a "priced-extra" option, the symbols we use over here.

Third, recognize RF and linear devices in the schematic package. I understand that they are working on these library options, and I want to be among the first to get my copy! After all, when I'm not working on RF projects I tend to be noodling about with op amps and other linear ICs.

Fourth, write a brief tutorial for the uninitiated on what a printed circuit board ought to look like. Really! I mean it. A very useful thing for the neophyte is some guidance on the sizes of tracks and pads, layouts, how close items can come to each other and other general knowledge that otherwise comes through experience. A little canned experience, learning from the wisdom of others, goes a long way for those smart enough to take advantage of it.

Other Products

Number One Systems offers other products in addition to the printed circuit layout software: an analog circuits analysis program, a digital logic analysis program, and a Smith Chart analysis program. I haven't reviewed these products so I can't comment on them, but if they are as good as EASY-PC, then they are probably a good bet. Contact the company at either the England or California addresses for details on these programs.

Conclusion

EASY-PC is a very capable, but low-cost, printed circuit design and schematic drawing package that will accommodate amateur users quite nicely. It prints out on ordinary dot matrix and laser printers, so it doesn't require an expensive collateral investment in plotters. Yet, for the professional user, it allows the use of plotters. It will also create the data file needed for automatic "numerical control" drilling machines, which are used in commercial production. EASY-PC is cost-competitive with other amateur grade layout programs, but is far more capable and easy to use than some of the others that I've seen. My opinion is that the next leap for greater capability in the commonly used products would be in the $1,800 price range. EASY-PC will do more than most amateurs will ever need, and for those who need more, give the "professional" version a try . . . it's cheaper than many other professional packages. 73

HAM HELP

Number 29 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I recently acquired a satellite dish, and I'm trying to get set up so t can receive the NASA Select Video feeds. I have a receiver that needs work, but I have no documentation on it. Any help obtaining documentation for the following items would be appreciated: LUXOR Model 9540 Satellite receiver; LUXOR Model 9534 Antenna Actuator (Positioner control). Any other tips, advice, equipment for sale (CHEAP!!), would be appreciated. Thanks. *Don Byrer KJ5KB, 216 23rd Ave. N.E., Norman OK 73071.*

WANTED: Manual for a KENWOOD AT-200 Antenna Tuner. I'll appreciate if someone can send me a copy of this manual. *Ruben Sanchez XE2NI, P.O. Box 3-4137, Monterrey NL 64460, Mexico.*

I need info on enabling full Xmit coverage on an ALINCO DJ-180T HT, for volunteer fire use. Thanks. *Bob Grater K6SUB, 631 E. Taylor Ave., Sunnyvale CA 94086.*

NEEDED: Instruction manual and schematic for the MX 2930H/USM Vertical Channel Dual Trace Preampl.; or the Model 162A Dual Trace Amplifier. I will pay reasonable copy costs. *M. Crosby, 1301 Touhy Ave., Apt. 212, Park Ridge IL 60068.*

I am looking for a shop manual or an owner's manual for a HALLICRAFTERS Model HT-40 (MARK-I) transmitter. I am willing to pay for it. Even copies would be helpful. Thanks. *Andre' Pelletier, 500 - Dineen APT #300, Labrador City Nfld., A2V 1E6 Canada. Tel./Fax: (709) 944-2540.*

NEEDED: Alignment instructions for the TEN-TEC Century 22 transceiver. Also, I would like to contact anyone with a Heath HWS-2 handheld with the optional PL encode/decode installed, who has found a way to disable the decode mode. *Glenn Torres KB5AYO, 584 Central Ave., Reserve LA 70084.*

73 Review

by Gordon West WB6NOA

"The Radio Doctor"

"Fix it and run it" videos.

Ham Repair
c/o Milton Lord N4DA
710 Teague Drive
Kennesaw GA 30144
Telephone: (404) 422-1415; (800) 788-1416
Price Class: $19.95–$39.95

Until now, we haven't seen much interest in video training cassettes for amateur radio. Our hobby seems to be too technical for complex matters to be digested in 78 minutes of mylar. While there have been attempts to offer videos to go from Novice through Extra in just 55 minutes of instruction, or to fully understand how to assemble a KT-34-XA step-by-step in just 68 minutes of tape, it's just not going to happen *in detail*. Hams know that, and that's why you don't see video titles for every subject of ham radio popping up in full-page ads.

That was until "The Radio Doctor" radio maintenance videos caught my attention. I regularly work on amateur radio equipment, and I would love to see a video that could give some inside hints on working on these specific radio transceivers:

Kenwood TS-850S
Yaesu FT-757
Kenwood TS-430S
Kenwood TS-440S
Kenwood TS-830S
Kenwood TS-930S

Several "Understanding and Assembling" Videos

I ordered a good selection of these videos, having no idea what I was going to get or what quality had gone into their production. I didn't have to wait long—the order was processed within 12 hours of when they received my check, and the videos arrived packed in a secure carton with not-so-fancy graphics on the outside.

I popped in the Yaesu FT-757 77-minute repair and tune-up video and endured the first minute of FBI copyright warnings, canned music, and the introduction by 'The Radio Doctor," Milton Lord N4DA, a licensed ham for over a quarter century with 20 years of experience in designing and servicing RF communications equipment. I became more intrigued by his low-key, friendly style of talking, about how "we" were going to open up the Yaesu and go into deep surgery.

Milton's son shoots the video over his dad's shoulder, using excellent lighting and professional video techniques. We systematically back out the screws to the equipment, catch some unique hints on how to pull the covers and get into the insides of the set, and then proceed to completely tear down the front panel to gain access to the heart of any problem that he is going to show us how to repair. The close-ups put you right there on the end of your tiny screwdriver—you can almost smell the solder cooking as "The Radio Doctor" pulls wires off the printed circuit board with the skill of an operating room surgeon.

His same unhurried, sincere technique in talking us through the repair and alignment of Kenwood radios was found on each of the other video tapes. The 72-minute Kenwood TS-940S finally gave me the definitive repair to cure PLL unlock, or a failure of the power supply, or a failure of the internal antenna coupler.

"Seventy-five percent of the problems occurring on the Kenwood TS-940S can be repaired using this video on your own test bench," comments Milton Lord. "I also show you alignment procedures, frequency calibration techniques much easier than what is described in the service manual, and power output modifications, as well as out-of-band transmit mods for the MARS operator."

And Lord knows what he's doing—you see every step in disassembling and reassembling printed circuit boards, and he gives you valuable hints on how to keep from accidentally ripping out solder traces, or inadvertently shorting something out when you accidentally lay the fold-out board down incorrectly.

After screening all of his videos, including a powerful set of tapes that describe how to tune up a kilowatt amplifier, how to pull packet RX out of most mobile 2 meter transceivers, and why the proper ALC settings are important to good linearity, I was convinced we really have someone sincere about producing good videos for getting things done, as opposed to simply a lot of videos to turn a quick buck. He works on these rigs on a daily basis and you can tell it by watching his techniques.

About the only mistake I could find in his dialogue was once when he referred to calibrating a piece of equipment that would zero beat WWV only when the frequency read 10.000.030 on the display. He described this as being 30 Hz high, when actually the radio is 30 Hz low in calibration, requiring the 30 Hz high offset for proper zero beat. Other than that, his dialogue is on the nose.

I phoned the technical types at Kenwood, Yaesu, and ICOM, and all three manufacturers agreed that Milton Lord has provided knowledgeable amateur radio operators a teaching tool that they have not had before. But all three companies urged the amateur operator to go no further in their radio surgery than their individual skill level in truly understanding what the problem and solution might be. But for actual "hands-on" technique, "Dr. Radio" shows you some tricks not found in the big technical service manuals.

"More videos on the newer sets are coming out as we speak," says Lord. For an up-to-date list on his ham radio repair videos, phone (404) 422-1415. I think you will be as impressed as I was with his sincerity and non-frantic detailed approach to learning how ham radios play and what happens when you need to fix them yourself.

Photo A. There are plenty of close-up shots on the Radio Doctor Videos.

HAMSATS

Number 10 on your Feedback card

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083

The AMSAT Annual Meeting

The 1993 AMSAT Annual Meeting and Space Symposium was held October 8-10, 1993, in Arlington, Texas. Over 170 satellite enthusiasts listened to dozens of presentations, examined satellite models and antennas on display, and made hamsat and moonbounce contacts using antenna arrays set up outside the convention hotel. For all participants it was a fantastic weekend. With the launch of more new hamsats on an Ariane rocket only two weeks earlier, spirits were high.

Friday

Although activities at the symposium began on Thursday with a tour ol electronic surplus stores in the Dallas/Fort Worth area, the paper presentations started Friday afternoon following a morning of antenna-test-range activity hosted by Kent Britain WA5VJB. Kent also gave a Friday talk on the use of metal booms to support amateur satellite antennas.

Rosalie White WA1STO of the American Radio Relay League got things started Friday afternoon with an ARRL/AMSAT educational workshop. Concurrent presentations included a status report on the SEDSAT-1 program by Dennis Wingo KD4ETA. SEDSAT is a microsat-class satellite that will be flying as a secondary payload as part of NASA's Small Expendable Deployer System (SEDS). It will be placed in a circular orbit at 730 km altitude with a 39-degree inclination. SEDSAT will carry several scientific and amateur-radio experiments. The main purpose of the satellite is to test the dynamics of tethered satellites and remote sensing.

AMSAT President Emeritus Dr. Tom Clark W3IWI discussed the status of UNAMSAT from the Autonomous University of Mexico. David Liberman XE1TU could not attend tc present the paper since the launch of UNAMSAT will be very soon. It is scheduled to ride to orbit on a converted Russian ICBM early in 1994.

Lyle Johnson WA7GXD talked to the group about ITAMSAT-A, now known as ITAMSAT-OSCAR-26. AMSAT-Italy Vice President of Engineering Alberto Zagni I2KBD could not attend the symposium due to ground control activities relating to the new Italian satellite. I-O-26 is in orbit and fully operational. It is based on the standard microsat structure but has advanced features and modifications. Last month's column gives more details.

Other Friday papers included those by Jeff Wallach N5ITU concerning high-resolution weather satellites, Dan Schultz on the Hubble Space Telescope service mission and a Shuttle Amateur Radio Experiment talk by Lou McFadin W5DID. Lou explained SAREX from a payload point of view. Friday evening included a trip to the Fort Worth stockyards cultural district and local cuisine.

Saturday

Activities began in earnest at 8 a.m.. AMSAT President Bill Tynan W3XO gave an official welcome to the symposium participants and introduced the first speaker, AMSAT Vice President of Engineering Dick Jansson WD4FAB. Dick gave a detailed description of the structural design of the new Phase-3-D spacecraft. Dick has produced countless engineering drawings for the construction of this new hamsat. His presentation was enhanced by many slides showing the design endeavors and sights in Germany where simultaneous engineering efforts are underway. Symposium participants were given the opportunity to ask Dick questions relating to the many challenges encountered in the project.

Peter Gulzow DB2OS of AMSAT-Germany followed with a narrative on the many electronic packages to be flown on Phase-3-D. This ambitious multi-million-dollar satellite will carry an array of receivers from 145 MHz to 5.6 GHz and transmitters from 29 MHz through 10.4 GHz. Several non-radio payloads are also under construction, including an atomic clock, a Global Positioning System (GPS) navigation experiment, radiation sensors, and a group of three Charged Coupled Device (CCD) cameras to provide pictures from the earth and planets in true color via the German digital communications unit. The proposed orbit is to be highly elliptical, similar to that of AMSAT-OSCAR-13.

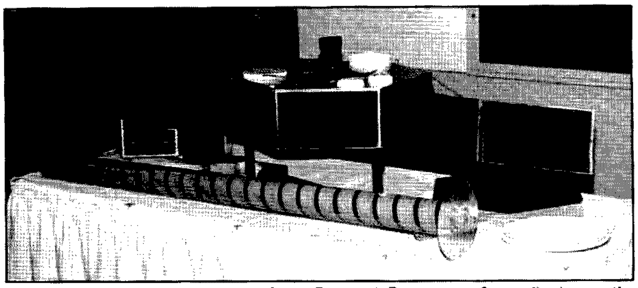


Photo A. Quarter-scale model of the Phase-3-D spacecraft on display at the AMSAT-NA Eleventh Space Symposium and General Meeting; October 8-10, 1993, in Arlington, Texas.

After a short break, Stan Wood WA4NFY presented a design review of the antenna systems to support the many radio modules carried on Phase-3-D. Ranging from a two-element "ZL-special" beam for 29 MHz to exotic patch antennas and dishes for the microwave bands, P-3-D will be covered with antennas.

Tom Clark W3IWI came to the podium again, this time to describe the inner workings of GPS and how it will be used on P-3-D. Several carefully-positioned GPS antennas will be needed on the satellite's surface to provide location and satellite orientation data. Tom also discussed terrestrial uses and equipment enhancements to allow better locating accuracy now available to experimenters and prospective users of GPS technology.

AMSAT Vice President of Manned Spacecraft Operations Frank Bauer KA3HDO provided insight on the status of SAREX and future missions. True to his predictions at the conference, the STS-58 flight ol the Shuttle *Columbia* was extremely successful both for school contacts with the astronaut-hams and for the general amateur radio community via general voice QSOs and packet connects with the SAREX Robot. Frank also explained the purpose of the SAREX working group that manages the day-to-day activities and provides guidance and direction for the program. In addition, he explained AMSAT's participation and how school groups are coordinated.

James Miller G3RUH made his first trip to North America to present his paper on "Managing OSCAR-13." James spends at least two hours each day collecting A-O-13 telemetry and determining the best operating schedule and satellite orientation. He and the other ground control stations are responsible for positioning the satellite to keep the batteries in good condition. James has been responsible for many hamsat advances over the years, including the first PSK kit for use with Fuji-OSCAR-12, a 400-baud PSK demodulator for A-O-13 telemetry and a 9600 baud modem for use with the newer, high-speed digital satellites.

Ed Krome KA9LNV gave a report on his efforts to develop a truly portable Mode "S" (2.4 GHz receive) ground station. Ed's small dish, made of screen mesh, wooden dowels and cord was quite a hit at the symposium. Ed also described his ventures with single-conversion receivers for

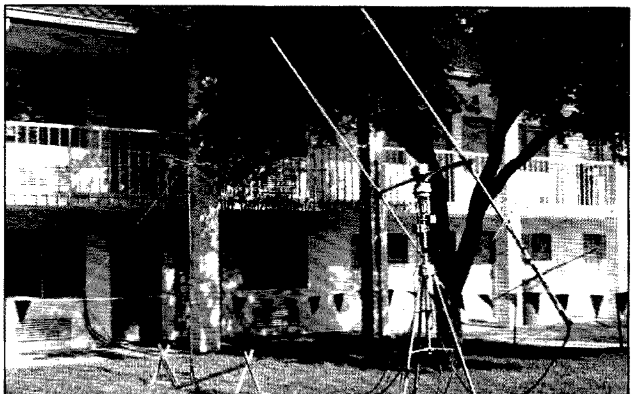


Photo B. One of the satellite antenna systems set up for OSCAR operation during the AMSAT-NA symposium.

Photo C. Doug Howard KG5OA attempts a contact with VE3ONT via the moon during the AMSAT symposium weekend.

Photo D. Ed Krome KA9LNV demonstrated his portable 2.4 GHz receive system for Mode "S" via OSCAR-13.

microwave reception.

Jim White WD0E discussed efforts to bring the *DOVE* satellite back online. He has been working with Bill McCaa K0RZ and Bob Diersing N5AHD to uplink new software to the satellite. Significant progress has been achieved by the team since the symposium weekend. Packet telemetry output has been enabled and digital voice transmissions are expected to follow.

Darrel Emerson AA7FV presented his findings on digital processing of weak signals buried in the noise. Using only a modest antenna system, Darrel has copied signals sent via A-O-13 30 dB below the signal level of the satellite's telemetry beacon. Using receiver filtering and tape-recordings that sound more like noise, he has analyzed the data using a sound-blaster-type board in a PC to literally extract information from the random background. The process was quite involved but yielded results and his description delighted the symposium attendees. Darrel has gone on to try his hand at other weak-signal detection experiments.

Other Saturday talks included those by Greg Jones WD5IVD concerning the joint TAPR/AMSAT DSP program, Bob Argyle KB7KCL on the status of the WEBERSAT project, and Brad Reed on commercial solar arrays for satellites. The long day concluded with a question and answer session with the AMSAT Board of Directors, a dinner banquet followed by a fine speech from AMSAT-UK Secretary Ron Broadbent G3AAJ, then the recognition awards and prize drawings.

Sunday

Following the Field Operations Breakfast at 7 a.m., the talks began again with AMSAT-LU (Argentina) Vice President Gustavo Carpignano LW2DTZ and his summary of the Voice Experiment Satellite (VOXSAT) program. With one very functional satellite already in orbit, the Argentina group is working to get another ready for orbit.

More papers were presented throughout the morning on topics ranging from microsat ground stations to the efforts in Sweden to develop a satellite education program. At the same time, the AMSAT Board of Directors meeting began.

Bill Tynan coordinated the board meeting which lasted through mid-Monday with a few breaks for food and sleep. The agenda covered many items including publications, SAREX, the DSP project status, long-range planning, commercial relationships, new satellites, and the budget. AMSAT has a significant challenge ahead to pay its part of P-3-D and still maintain its many other activities. Work on fund raising will continue to dominate AMSAT's operations 'til launch in late 1996.

Photo E. Ed Krome KA9LNV at home with the three-foot dish for SSB reception using OSCAR-13 and his 15-inch "WOK" reflector for successful CW reception via 2.4 GHz, Mode "S." (KA9LNV photo.)

The North Texas AMSAT group did a great job coordinating the AMSAT Space Symposium and General Meeting in 1993. Orlando, Florida, is the site for the 1994 meeting. It is sure to be a fascinating event since many of the key mechanical parts for Phase-3-D will be there for participants to see.

Copies of the *Proceedings* of the symposium are available from AMSAT or the ARRL. The book is 8-1/2" by 11", nearly 300 pages, and softbound. It's well worth the cover price of $12. AMSAT can be contacted at 1-213-589-6062 for details on shipping charges.

Straight Key Night

For many years the ARRL has sponsored Straight Key Night (SKN) on New Year's Eve and New Year's Day. In 1972 a group of satellite chasers decided to try their hand at some straight key CW via OSCAR-6 during SKN. The idea caught on and the tradition has been maintained whenever there has been a satellite available for the event.

AMSAT Executive Vice President Ray Soifer W2RS invites interested satellite operators to participate in the 22nd annual SKN via OSCAR. He reports that there are no rules, no scoring and no need to send in a log. Just call CQ SKN in the CW passband segment of an OSCAR between 0000 and 2359 UTC on January 1, 1994, or answer a CQ SKN call from another station. Contacts via the moon also count. Nominations for best "fist" can be sent to W2RS @ WA2SNA.NJ.USA.NA via packet, or toW2RS@AMSAT.ORG via the Internet. You can also use his *Callbook* address. ■

RTTY LOOP

Number 11 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Happy New Year! As we begin 1994, let's cuddle up by the fire with some letters and see what you all have to say.

The OS-9

Daniel P. Lindsley N5AGG of Bath, Maine, writes regarding a reference to OS-9 in the September 1993 column. He has worked with Motorola 6800s for some time and has never heard of it, and wonders just what it is.

Well, Daniel, as you are aware, a microprocessor is just a chip until some program tells it to do something. In most general purpose computers, a supervisory program, called an Operating System, handles the tasks of input/output (I/O), communicating with storage devices, memory, and the like. In the case of the currently popular Intel-based systems, the supervisory program is the MicroSoft Disk Operating System, or MS-DOS. In the dim Dark Ages of eight-bit (or, shudder, four-bit) computing, we often called it a "monitor" program, and each chip had its own. A common program to run the Motorola 6800 was the MIKBUG program, distributed by Motorola. A bit later came SWTBUG, from Southwest Technical Products, and other simple monitors.

With the introduction of the 6809 CPU, Motorola and Microware Systems Corporation got together and modeled an operating system based on UNIX, which had been pioneered at Bell Laboratories. Much of what OS-9 encompassed, while familiar to us now, was at the cutting edge of innovation in the early 1980s. A system composed of a kernel, unified input/output system, and device drivers characterized OS-9, and allowed it to implement a multi-user, multitasking operating system while Intel chips were just starting to access hard drives.

One of the primary marketing strongholds at the time was the Tandy Corporation which, through its Radio Shack stores, had introduced the Tandy Color Computer, based on the 6809 chip. By porting OS-9 to the Color Computer, Tandy spawned a cottage industry of add-on products, including displays, storage devices, and other accessories, that vastly expanded the capacity of what would otherwise be a simple little computer. Unfortunately, OS-9 suffered from one central flaw: lack of software support. While basic programs, such as word processors, spreadsheets, and games, were available for OS-9 systems, the rapid growth of the MS-DOS system at the same time usurped the impetus for software innovation, and the system slowly withered and died. Tandy ceased supporting it, and no major manufacturer stepped in.

You can still find some independent sources for OS-9 if you look around, and every once in a while a local Radio Shack will have a clearance sale on software or hardware. Keep your eyes open and you might luck out.

Needed and Offered Items

Last month, I presented some information about the Flesher TU-470 terminal unit. Well, "Mitch" Mitchell WA4OSR of Mobile, Alabama, is looking for some help with the IRL FSK-1000. He would like to use the unit on RTTY, but does not have a manual for it. Does anyone out there have a manual we could forward to Mitch? Let me know, and I'll try to put you in touch. He is also looking for a HAL CRI-200 modem. He says he had one of these a while back, but he let a friend talk him out of it. If you have one that you would be willing to part with, send that information along as well.

California hams, listen up. Joseph J. Brugman WB6ALI in Whittier, California tells us that he will be moving in a few months, and will need to dispose of some equipment. He asks if someone wants a museum piece, or if he will have to haul it to the dump. The items in question are an old Model 15, a Model 19, and an ASR-33 teleprinter. He is anxious to hear from anyone who wants any or all of these, presuming they are still available when this column is printed. Let me know, and I will send the information to him forthwith!

Thanks to Rich Carter KN4WJ who came through with a solution for Michael Mihailovic VK2OZ in Sydney, Australia. Michael was looking for some older Kantronics information on AMTOR, and Rich had a copy of the book he was looking for. A copy of same is now winging its way Down Under, and I thank Rich for lending a hand.

Norman Beasley P29NB/KO4CB in Papua, New Guinea, writes wondering if any of the RTTY programs around will work with modems built into laptop computers. I really don't think so, Norm. You see, the tone pairs used for RTTY are just straightforward frequency shift keying, whereas, depending on baud rate, telephone modem tones can be straight tones all the way up to modulated sets of tones. So, sorry to say, I don't think it is practical.

At least one of the programs around, BayCom, which is part of the "RTTY Loop" collection described below, comes with a circuit for a simple interface. If you want to keep things simple that may well be one way to go.

Where to Find RTTY

Several of you have recently asked that perennial question, "Where can I find RTTY?" Well, let me give you two frequencies and a suggestion. On HF, the most active RTTY frequency centers around 3620 kHz and 14080 kHz. These are both FSK, of course, and 60 wpm, 45.45 baud, Baudot still predominates. On VHF, my suggestion is to ask around. In some areas, you will find a simplex frequency active; in others there may be an RTTY repeater. Listen and ask, and you may turn something up. Packet or AMTOR are different subjects, and we may touch on them another time.

Regards as well to Bud Boulton WA8CFP of Spring Hill, Florida. Yes, the four "RTTY Loop" collections remain available. Collections #1, #2, and #4 are compendiums of ham radio, RTTY, and packet programs culled from various sources. Collection #3 is an assortment of archiving and dearchiving utilities essential to efficient operation. Each may be had by sending me sufficient blank disks, return stamped mailers, and $2 per disk to be filled, specifying the collection or collections desired. Remember that each collection just about fills a 3.5" 1.44 Mb high density disk, so if you are sending disks of lesser capacity, adjust the quantity accordingly.

As always, please contact me at the above address, or electronically via CompuServe (ppn 75036,2501), America Online (MarcWA3AJR), or Delphi (MarcWA3AJR). Inventive users have even sent Email through electronic portals from other services to me on CompuServe and AOL—isn't the global community wonderful?

One of the items in the works includes a look back to an interesting circuit published in *73* over 10 years ago. That's from a reader's question. Feel free to ask yours! I look forward to it. 73

UPDATES

Number 12 on your Feedback card

The FARA Project

Drilled and etched PC boards are now available for the above-mentioned 2 meter amplifier project (November 1993, p. 10). You can order one from FAR Circuits, 18N640 Field Ct., Dundee IL 60118. The price is $9 plus $1.50 S&H.

You may also be interested in knowing the relay K1 is available from Mouser Electronics, (800) 346-6873, Part Number 431-OVR-SH-212L. The Bud Box is available from Gerber Electronics, (800) 225-1800. Q1 is available from RF Parts, (800) 737-2787. Happy home-brewing! 73

CARR'S CORNER

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Building Small DC Power Supplies, Part 2: The Voltage Regulated Supply

Last month we took a brief look at the basic low-voltage, low-current (LVLC) DC power supply. These supplies are used to power solid-state circuits. They have output voltage ratings of 1.5 VDC to 28 VDC, with +5 VDC, +9 VDC and +12 VDC being most common. Some circuits also need negative output voltages in the same values. The current ratings range from 100 mA to 5 amperes, with 1 ampere (1,000 mA) being most common. In this installment, we will take a look at small voltage-regulated power supplies.

Why Voltage Regulation?

Most electronic circuits work better when the applied DC voltage is stable. Oscillators, for example, will "pull" slightly in frequency when the DC power supply voltage changes. When you hear it on CW, this phenomenon is called "chirp," and is undesirable (not to mention illegal).

The principal reasons that DC power supply outputs vary are: 1) variation in the AC input voltage and 2) variation in the load current drawn from the power supply. The input voltage variation is from the AC power mains, and there is little practical that one can do about it on the AC side. Normally, the "110 volt" AC line will vary from 105 to 125 VAC RMS. At my house, the meter tends to sit between 120 and 124 volts most of the time. During "brown-out" conditions, seen mostly in the summer months when huge amounts of current from air conditioners strain the *system*, the voltage might drop to 95 volts or so.

The mechanism of voltage variation from changes in DC load current is shown in Figure 1. Here we have a representative "equivalent circuit" containing a load resistance (R_L), a load current (I), an ideal (lossless) voltage source (V), and an internal resistance (R_S). It is this internal resistance that is the problem. When switch S1 is open, the load is disconnected from the power supply. Voltmeter M1 will read the full value of V. At this time, Vo does not appear. But when S1 is closed, the load is connected to the voltage source, and current I flows. The output voltage V_O will be V - V_S, or V - IR_S. As I varies, so do V_S and V_O.

Although one can reduce the effects of the load current variation, it cannot be eliminated altogether. The "cure" is to make the current capacity of the power supply much larger than the required load current. But this method is expensive, wasteful and heavy (components weigh a lot). A better way is to use voltage regulation . . . it will take care of both forms of variation.

Another value for voltage regulation was shown to me by a salesman named Walter who used to call on a shop where I was employed in the early 1960s. We serviced car radios and two-way radios, and as a result required bench power supplies. Walter came in and told me he could sell me a DC bench power supply " . . . with the equivalent of 1,000,000 µF (1 farad) of ripple filtering. Although I was initially skeptical, Walter was right. The power supply was voltage-regulated (a rarity in those days) with a solid-state voltage regulator circuit, and the voltage regulation reduces dramatically the amount of ripple.

Photo A shows the ripple before (top trace) and after (bottom trace) the voltage regulator circuit. The circuit used for this measurement was a moderately loaded 12 VDC, 1 ampere, DC power supply. Note that the "before" ripple is about the same as we saw last month for the 1,000 µF case. The ripple factor was about 400 mV. The bottom trace shows 5 mV of ripple which, because the top and bottom scales were taken using the same vertical deflection factor, barely makes a difference from a purely straight line. That's where Walter got his "1,000,000 µF" of ripple reduction.

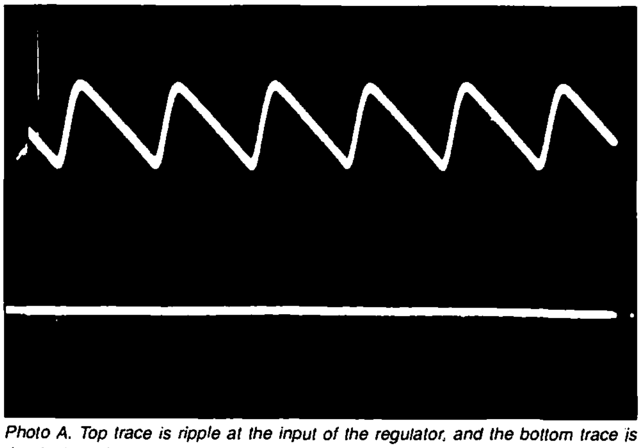

Photo A. Top trace is ripple at the input of the regulator, and the bottom trace is the ripple at the output (to same scale).

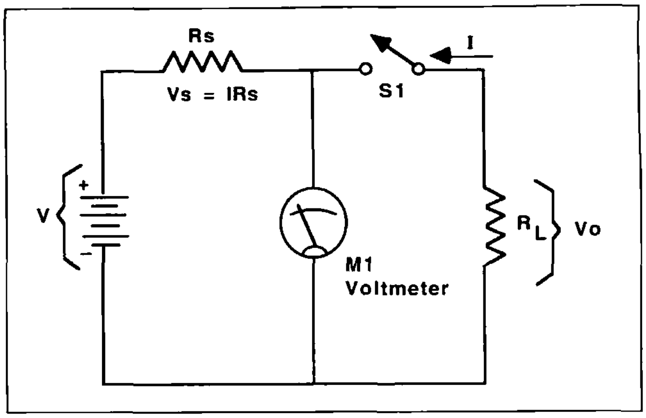

Figure 1. Equivalent circuit showing how voltage variation occurs.

Figure 2 shows the basic circuit for a voltage-regulated DC power supply that is based on the circuit we discussed last month, married to a three-terminal integrated circuit voltage regulator device (IC1). The rectifier is selected according to the criteria we used last month, i.e. a peak inverse voltage (PIV) of not less than 2.83 times the RMS voltage of the transformer (T1) secondary, and a forward current rating equal to not less than the maximum load current (plus a little reserve if you are conservative). As a practical matter, a 1,000 volt PIV, 1 ampere bridge rectifier will suffice for all 5 to 28 volt DC, 1 ampere, power supplies.

The regulator shown here is a positive voltage regulator; i.e. the input and output voltages are positive with respect to common (which in this case is a chassis ground). Several different forms of regulator are available in various combinations of current and regulated output voltage. For positive regulators, the two main lines are the LM-340n-xx and the 78xx (which for practical purposes are interchangeable). In both cases, the "xx" is replaced with the required output voltage, and the "n" with a letter denoting the package style. For example, the LM-340-05 (or LM-340-5) and 7805 are +5 VDC output regulators, while the LM-340-12 and 7812 are +12 volt regulators.

The current rating of the voltage regulator is given by a letter designation in the LM-340n-xx series, and sometimes in the 78xx series as well. The "T" package is a TO-220 three-lead plastic package similar to certain plastic audio power transistors. It is often rated at 1,000 mA (1A), although without a good heat sink 750 mA is more like it. The "K" package is the same as a TO-3 diamond-shaped power transistor package. It is good for 1 ampere, and in certain configurations (with a heat sink) up to 5 amperes. For example, the LM-323 is a +5 VDC, 3 amp regulator, while LM-338 is a 5 amp variable voltage regulator. In labeling the LM-340n-xx, therefore, an LM-340T-xx is capable of 750/1000 mA depending on heat sinking or your courage, and LM-340K-xx is a 1 ampere regulator.

The filter capacitor in Figure 2 is C3. The general rule for setting the value of this ripple filler for voltage-regulated circuits is to use 2,000 µF per ampere of maximum load current (some people accept 1,000 µF/ampere). For this reason, in the 1 ampere supply of Figure 2, the capacitor is set to 2,000 µF (more can be used, if desired—it's not that critical).

Capacitors C4 and C5 are intended to guard the regulator (IC1) from noise transients propagated on the input power, and from RF that gets into the circuit. These capacitors should be 0.1 µF to 1.0 µF, and are mounted as close as possible to the body of the voltage regulator. Capacitor C6 is set according to the rule: 100 µF/ampere. Its purpose is to guard against sudden, rapid rise time, changes in load current demand. It holds a small charge that dumps into the circuit when the load changes, while giving the regulator its necessary milliseconds to catch up. Capacitor C7 is optional, but is required in power supplies used in ham stations. It guards against the RF that might arrive through the DC output terminals. Place C7 as close as possible to the output terminals.

Diode D1 is used to prevent charge in capacitor C6 from causing damage to the voltage regulator during shutdown. It has a current rating of 1 ampere, and a voltage rating of 1,000 volts PIV.

Note that a heat sink is shown on IC1, the voltage regulator IC device. If the regulator is used in a circuit that can output more than about half the full rated output of the regulator, then it's a good idea to use a heat sink.

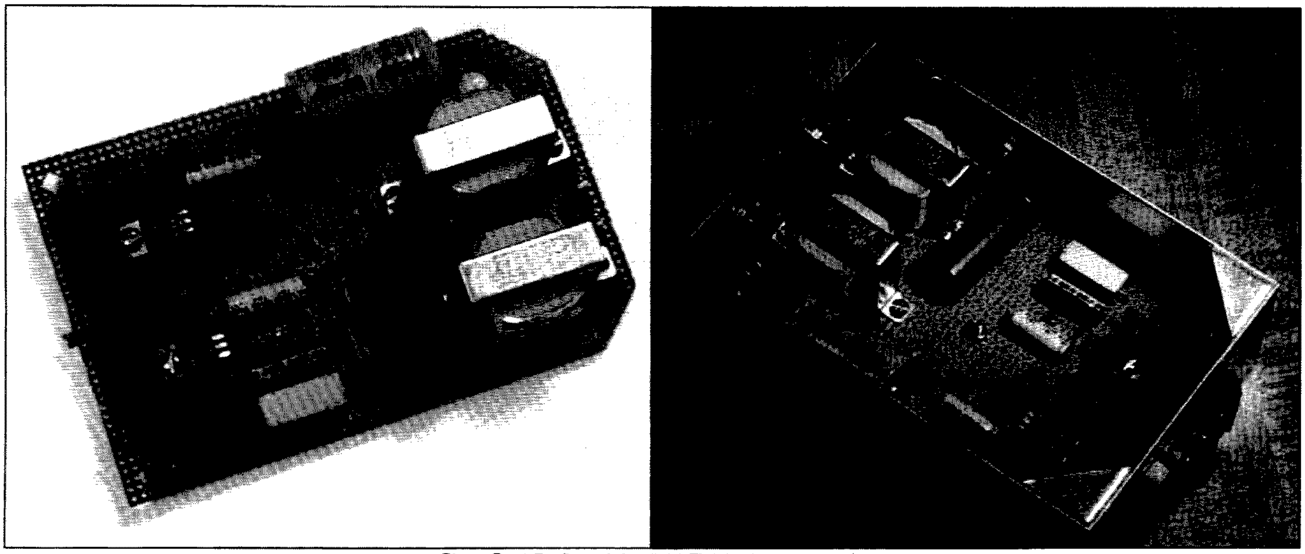

Photo B. a) Perfboard detail; b) Finished power supply.

The mounting tab of "T" package devices, and the case on "K" package devices, is also ground, so be aware that the heat sink will also be ground (keep hot leads away from it).

Photo B(a) shows the construction of a simple 1 ampere, low voltage DC power supply wiring board, while Photo B(b) shows a typical finished product. The wiring is done "point-to-point" on the back of a piece of perforated wiring board. This board is available from most parts distributors (for perfboard and other DC power supply components, see the catalog of Ocean State Electronics, POB 1458, Westerly RI 02891; 1-800-866-6626). Note in Photo B(a) the use of heat sinks on the "T" package regulators. Also note the wide spacing between the heat sinks. Also note that the transformers are mounted on the board. This type of construction should only be used for small, low-current applications. Heavier transformers will best be mounted on the chassis.

The chassis shown here is a shielded box . . . which is a good idea for a regulated power supply used around (or inside) radio transmitting equipment. For a bench power supply, use an appropriate cabinet.

Packet Radio Buffs

Dave Wolf WO5H sent me a copy of his new *Packet Power Newsletter*. It's an eight-page monthly intended to keep packet buffs up to date. He tells me that readers of this column can get a free complimentary copy if they mention this column and send a self-addressed stamped envelope (SASE). Sample copies are normally $1. Looks pretty good for packet buffs.

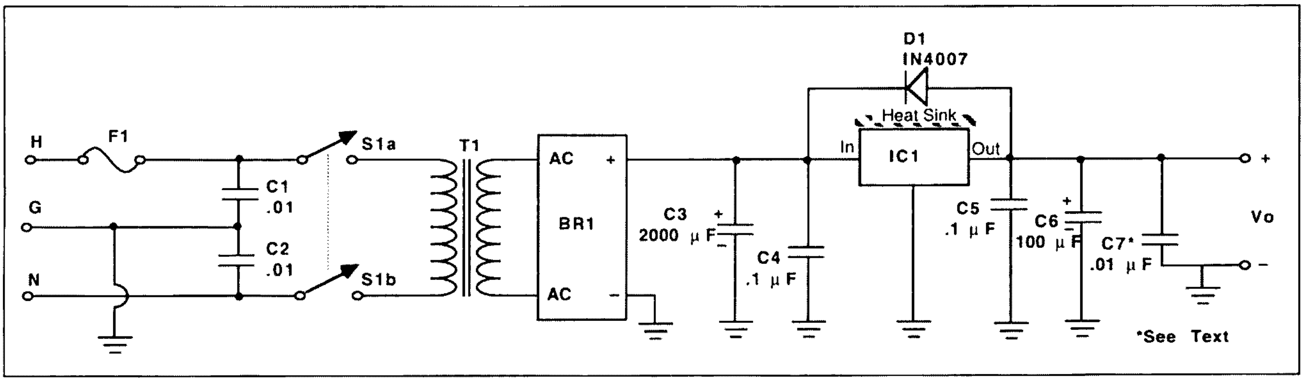

Figure 2. Circuit for the basic voltage regulator power supply.

HOMING IN

Number 15 on your Feedback card

Radio Direction Finding

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Ploys and Pranks

"If I had to choose just one part of ham radio to do all the time, it would be transmitter hunting. I love it!" Those aren't my words, though they could be. They came from Tom Lewis AB5CK of Grapevine, Texas. Hams from all over have expressed similar sentiments to me in letters and e-mail about radio direction finding (RDF) activities. T-hunts and foxhunts (as competitive RDF events are called) continue to attract new participants across the country and around the world.

Be prepared for adventure when you set out on a mobile hidden transmitter hunt. You never know where you'll end up and you can never be sure what you'll find. A good "fox" will have some surprises planned to challenge your RDF and deductive abilities. Your fellow hunters will be doing their best to see that you don't find the T first or have lowest elapsed mileage, depending on the rules of the hunt.

In previous "Homing In" columns, I categorized the sneaky, yet legal, techniques for confounding hunters, namely:

1. Deceptive signal parameters
2. Apparent inaccessibility
3. Indirect signal paths
4. Concealment and camouflage

I have explained that a hunt can be made easy or hard depending on the hider's choice of power level, antenna aiming, signal polarization, and transmitter timing. Darryl Widman KF6DI must have read this because his transmitter timing gave fits to participants in the advanced mobile hunt at the 1993 ARRL Southwestern Division convention in Ventura, California. Each signal burst was only a fifth of a second in duration. Transmissions were six seconds apart.

As a hunter in this event, I can attest to the difficulty of trying to read signal strength of a 200-millisecond signal pulse on a heavily-damped S-meter. A fast bar graph or audio tone strength indicator worked much better. A Doppler set is usually the best choice of RDF gear for a hunt like this, but I didn't have mine along. Only one team used a Doppler that day. That pair did not find the transmitter, probably due to copious signal reflections. The others did, eventually.

KF6DI's T was 40 miles up the coast in Santa Barbara, nestled in heavy brush at the base of a tree. The J antenna up in the branches was well camouflaged with green garden hose around the elements (Photo A). Not far away was a box at the base of another tree that flashed and clicked at the same rate as the real T. Anyone finding and reporting this decoy to the huntmaster wasted valuable time on this first-finder-wins event.

Photo A. Darryl Widman KF6DI checks for signal from his short-burst transmitter at the base of the tree behind him. Its J antenna is camouflaged in the upper branches. Can you see it?

Hamfest High Jinks

Most regularly scheduled T-hunts have a set of firm rules that bound the hunt area and establish the expected hidden T on/off timing. These rules usually prohibit moving or multiple transmitters except on advanced level hunts. At conventions and hamfests, however, there need be no hunt rules. Hiders have much more latitude. A valuable prize warrants a special challenge. Some hiders say, "If the hunters don't complain, the hunt wasn't hard enough."

The two-hour on-foot foxhunt at the 1993 ARRL Texas State convention was not too hard and not too easy. According to hunter Tom Lewis AB5CK, "The only information provided was that there were multiple T's transmitting at different times on the same frequency. Ticket stubs were given out sequentially at each T, and the lowest numbered stubs would determine the winner in the event of a tie. After the hunt, we learned that there were seven foxes. Five of them were hams using handie-talkies, positioned at various locations around the convention property.

"The last two foxes were more difficult," Tom wrote. "One was remotely operated in the middle of a large open field of tall grass. It was impossible to see unless you were standing directly over it. The last one was even tougher. A ham had it hidden in his briefcase while he milled around the flea market as if he were shopping. There had never been a moving T at this convention before.

"By the way," AB5CK continues, "the ham carrying the briefcase was the same guy who pulled off a trick T at the convention the year before. He positioned himself in the middle of the flea market with his rig hidden inside a gutted video camera mounted on a tripod. Most of the hunters ran right past him, seeking other T's on the same frequency."

It's great to see the number of hamfest hunts growing. 1993 was the first year for T-hunting at the ARRL state convention at Virginia Beach, Virginia. Jeff Goldstein N4AVJ knew that most competitors would be beginners, so he made his hunt fairly short and simple. But he put out a few decoy pseudo-transmitters in the field at the end point to make things interesting (Photo B).

Canadian Capers

My last visit to Quebec was memorable because of a great Montreal

Photo B. Is it a fox or a decoy? James Lambert KC4YIW and Clifton Ireland KN4DV check out a mysterious box during the 1993 Virginia Beach Hamfest T-hunt.

Symphony concert. On my next trip there, I want to go T-hunting. It has really caught on in recent months. "Intrepid" is the word for Montreal T-hunters, as they hold hunts all year long. I guess I need to add snowshoes to the suggested hunting gear list!

Eldor Gemst VE3HUG reports Montreal T-hunt activities in the *marcOgram*, his club's newsletter, and also on CompuServe. He says that most hunts are interclub events among the two English and tour French ham organizations in the area. His description of the September outing shows the extreme lengths to which Quebec foxes go to foil hunters.

'The organizers of this hunt work for Hydro Quebec, so they had the full resources of that organization behind them," Eldor wrote. "All the bearings led to some railroad tracks with quite heavy brush on both sides. The tracks were fenced in, although the fence had some barely human-sized holes in it. The trick was figuring out which side of the tracks the fox was hidden on. Crossing the tracks could be easily done only in places about three miles on either side of the hottest signal zone, so you had to be pretty sure what side to approach from."

"We guessed wrong," says VE3HUG, "and we had to crawl through the broken fence. At this point we were certain that the T was somewhere inside the fence either in the bush or near the tracks. We searched high and low and eventually found it on the other side of the tracks. Outside the fence was a little dirt path with a "No Trespassing" sign. Barring entrance to the area were two cement posts with heavy pipes in them. At the top of the pipes were caps with a length of chain attached."

Eldor continues, "It turned out that those posts were fakes! The hiders had poured the cement forms around metal-colored plastic pipes and put plastic caps on top. They looked absolutely real. Everyone was certain that the fox lay behind the posts, either in the brush or by the tracks. But the transmitter was actually inside one of the pipes. The numbered tags for hunters to take, showing what position they came in, were only a quarter-inch square and the numbers were in Roman numerals. The material was some kind of metalized stuff laminated with plastic, the same color as the pipe. You'd look at the numbers and think it was some kind of identification of the pipe. Incredible!"

That hunt will be hard to top, but you can be sure the next hiders will try. Note that the T was not actually inside the "No Trespassing" area, which would be against the rules on most hunts. Usually Ts can be hidden on private property only if the area is freely accessible to the public at no charge and is not posted as a "No Trespassing" zone.


Photo C. Christie Holoubek KØIU is under the tattered straw hat, playing a "bag lady" as fox for the Fullerton Radio Club's monthly nighttime mobile hunt. Look closely to see the battery in the cart.

Shopping Cart Shenanigans

When asked to name a memorable T-hunt, most RDFers will bring up one in which the T was concealed in a particularly clever way. It doesn't have to be a grueling event like the Montreal hunt described above. Christie Holoubek KØIU showed her acting skills by portraying a bag lady in a mall parking lot on a Fullerton (California) Radio Club night hunt. She pushed a junk-laden shopping cart around the lot for three hours with the transmitter concealed among the refuse (Photo C). After 15 miles of mobiling and a drive around the parking lot, would you have suspected her?

Shopping carts are "liberated" from supermarkets every day, but Gary Holoubek WB6GCT asked permission to borrow this one. "Don Frizielle W6HRC and I went to a store and explained to the manager what we wanted to do," he says. "In case security guards thought we had stolen the cart, we had the manager give us his business card with a note on the

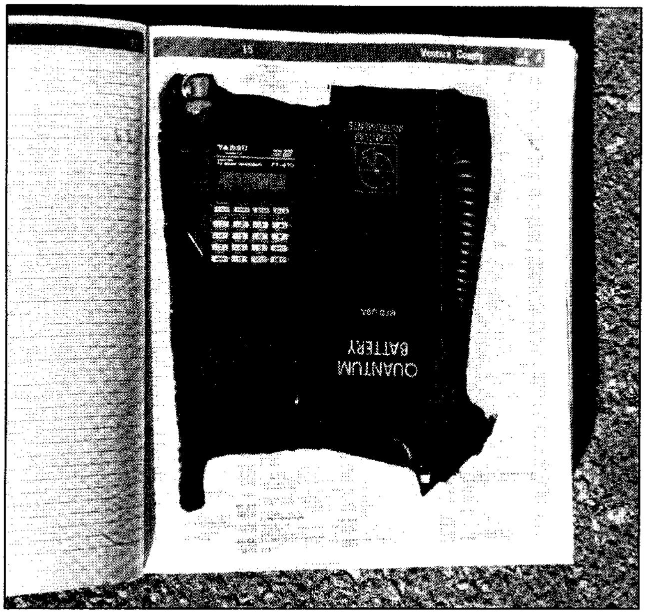

Photo D. *Trust your instruments, not your eyes, when sniffing. This hollowed-out phone book in a hotel lobby contained the T at a hamfest beginners' hunt.*

back. He was willing to loan us a brand-new cart, but we picked out a ratty looking one with good wheels. After the hunt, we took it right back."

Even a so-called "beginners'" hunt can include a clever concealment surprise. At the aforementioned convention in Ventura, California, KF6DI put on another event especially for brand-new RDFers. It was an on-foot hunt on the hotel grounds. Darryl encouraged everyone to give it a try, even those with no special RDF gear. (The "body shielding" maneuver with a handie-talkie or scanner was adequate for getting bearings.)

As usual, most of these new hunters assumed that the hidden T would be in plain sight, so they hunted mostly with their eyes, not their radios. That was the wrong thing to do! The rig was concealed inside a hollowed-out telephone book (Photo D) underneath a pay phone in the hotel lobby. Most hunters ignored the innocent-looking white pages and kept poking around for something in plain sight that looked like a radio.

Many memorable T-hunts involve lakes and rivers. Baffling bearings can result when the signal source is at the surface of a body of water, due to signal reflections from nearby and distant shores. For one Fullerton Radio Club hunt, Erik Schoedl N6NWW and Michael Foster KC6NHJ transmitted from a rubber duck. No, not a flexible helical 2 meter whip, I mean a real rubber duck, floating on a small lake in Tri-County Park. The real ducks ignored it, mostly.

Marty Mitchell N6ZAV and Byon Garrabrant KD6BCH went a step further, trying for invisibility on an Orange County night hunt in October. They attached a thin 2 meter whip to a piece of black-painted styrofoam and attempted to float it onto a lake with miniature coax back to the transmitter on the muddy shore.

"We put ballast under the styrofoam to hold the antenna erect," Marty says. "Apparently something tangled underwater and the thing kept sinking. My RaCon foxbox got soaked. Next time maybe we'll try putting the T in a radio-controlled submarine. We could eliminate the coax and be able to raise and lower the antenna!"

Keep It Fun

As you can see, being the hidden fox is an opportunity to unleash all your creativity. But don't forget to be fair and to match your subterfuge to the skill level of the hunters. If the majority of them are beginners, go easy by giving plenty of signal, frequent (if not continuous) transmissions, and lots of encouragement. Give them a challenge, but not an impossible task.

As your group's average skill level and equipment inventory increases toward the "expert" category, you can make hunts tougher by shortening transmissions, lowering or varying the signal level, increasing distance, and including stunts like those described above. Of course you won't do anything illegal or make the hunt unsafe for yourself or any hunter, will you? Remember that if participants don't have fun (however they define it), they won't come out to hunt you again next time. Your goal should be to increase the level of camaraderie of the hunt group.

Let's hear about the clever pranks taking place on your local foxhunts. Mail photos and stories to me at the address above. You can send e-mail to JoeMoell@cup.portal.com via Internet or to 75236,2165 on CompuServe. 73

Number 16 on your Feedback card

HAMS WITH CLASS

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Instructors' Workshop

This past summer, I had the pleasure of moderating the workshop for teachers and instructors at the Texas HamCom in Arlington. All those who attended for the full five hours received continuing education credit for 0.5 units. We had 80 folks who came to get ideas and share experiences of using amateur radio in the classroom. It was great!

Due to the length of the workshop, I wanted to be sure to have some lively, interesting speakers. I think that everyone in attendance will agree that every speaker presented valuable information in an "entertaining" manner. Matt McCullar KJ5BA spoke about his and his club's efforts with weather balloons and ham radio. He not only brought us the actual box the rig was packed in, he had a wonderful slide presentation of actual balloon-in-flight pictures to show. The visual aids that each speaker used added a great deal to the presentations.

Vicki Gigante KA3PBS not only joined me as cospeaker at the banquet that weekend, she also made a terrific presentation at the workshop. Vicki is in charge of shuttle retransmissions at the Goddard Space Center. She spoke about SAREX (Shuttle Amateur Radio Experiment) and its use in the classroom with youngsters. I agree with Vicki, based on first hand experience, that one of the best and most exciting things you can do with kids in the classroom with a radio is to give them an opportunity to speak with astronauts.

Cynthia Wall KA7ITT is the talented author of children's books that incorporate amateur radio in the story. It was a delightful experience to meet with her and hear her suggestions on using the books to help provide high motivational classroom reading lessons. I can really recommend these exciting adventure books as an enrichment activity in a ham radio class.

My good friend Jim Wilmerding N4MDC came from New Orleans just to participate in the workshop. I'm so glad that he did! Jim is one of the net controls on my CQ All Schools Net on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz (after 10 minutes 21.324, and then on to 14.325 MHz if you hear nothing). When folks can't hear either my school or Gordon West from California, they can probably pick up Jim in the middle of the country. Jim is the principal at St. Martin's Episcopal Middle School. Our two schools have corresponded and shared numerous school-wide projects as a direct result of our radio contacts each week. Jim spoke to the group about how to approach an administrator when trying to get a radio program into a school. His input was excellent.

Photo A. Jim Wilmerding N4MDC.

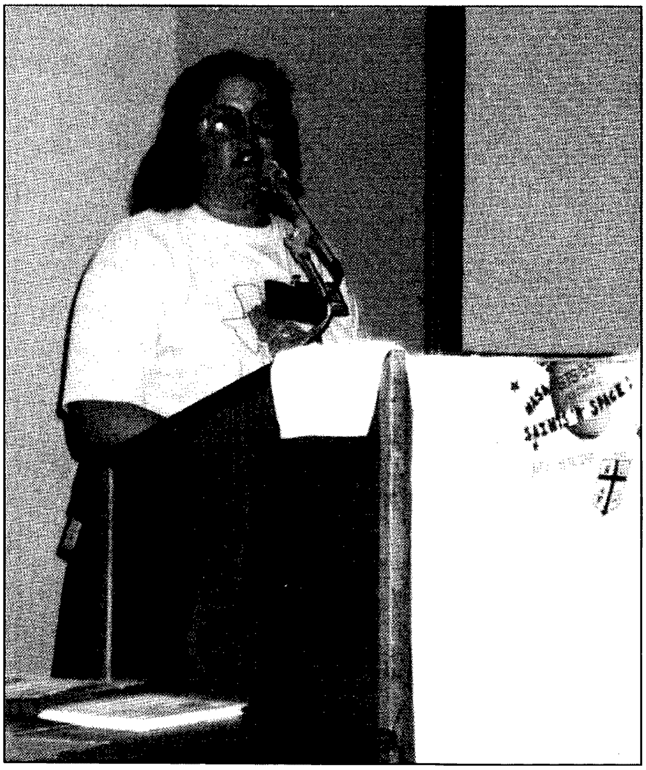

Photo B. Connie Dunn KB5LES.

Connie Dunn KB5LES was my liason with the convention most of the year. We became instant friends. Connie is very active with the YLs and does a super job editing their publication. She spoke about using packet radio in the classroom, and had very good slides to demonstrate what she was explaining. Connie introduced Kathy Hootman N5VKY, a teacher at Sanger Middle School, who talked about creative lessons with packet radio in her class.

My friend Bob Scupp WB5YYX is Vice Director of the Rocky Mountain Division of the ARRL. He informed the audience about the League's ability to support educational efforts. The new telephone number available to non-hams only is 800-32-NEW HAM to have questions answered. He provided the group with literature that the ARRL makes available to teachers.

It was also my pleasure to introduce the Geisen family who drove up from Houston to appear at my Youth Forum the next day. Marie KB5QPB, Shalon KB5QMY and Linda KB5PQW are home-schooled teenagers who have integrated ham radio into their studies.

In between these speakers, I managed to do some of my own little presentations. I showed a video that demonstrates children in my class having fun on the radio and with radio-related activities. I stressed the importance of using child-oriented materials. The group really enjoyed the other video I showed, astronauts fooling around for the camera to demonstrate weightlessness and how life on board the shuttle can be fun at times.

I am indebted to the talented people who did presentations at the Instructors' Workshop so that others could benefit from their experience. Readers of the "Hams With Class" column know that I am a firm believer in the value of youth forums for the recruiting of young people into the hobby. It is also very obvious to me, after having moderated several teacher continuing education courses, that they can inspire and motivate teachers to incorporate amateur radio in their classrooms. The sharing of ideas with a good group of presenters is a dynamic, exciting and educational experience.

Don't be afraid to organize one at your group's next large gathering, and let me know how it works out. 73

QRP

Number 17 on your Feedback card

Low Power Operation

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A very popular setup for the active QRPer is the Ten-Tec 509 Argonaut with its matching 405 amplifier. With DC power consumption of 100 watts, the 405 amplifier produces 50 watts RF output with only 2 watts input from 80 through 10 meters. This amplifier was one of the first all-solid-state high-power amplifiers to hit the ham market.

When Ten-Tec stopped producing the popular Argonaut 509, they introduced the 515. The 515 contains an enhanced version of the 509, with a few more features added. However, the FCC ban on 10 meter amplifiers made it illegal to build an amplifier capable of working with the 2 watts input from the Argonaut series. Therefore, they never offered a matching 406 amplifier for the 515 Argo.

The 10 meter amplifier bill, as it is known, made it illegal to sell any device that will amplify an RF signal between 24 MHz and 30 MHz. The bill was introduced in the mid 1970s—a reaction to the growing number of sellers and users of illegal power amps on the nearby 11 meter CB band. Under the law, the amplifier must not be able to amplify a signal under 50 watts input power, and the amplifier must not use RF sensed switching. As you can see, this put the 405 right in the middle of a very deep can of worms.

The whole idea behind the bill was to keep those amplifiers capable of operating on the CB band (27 MHz) out of the hands of CBers. There were some who likened this bill to a sort of gun control for ham radio. The rule's usefulness is still being debated to this very day: Is it effective in keeping those amplifiers away from 27 MHz? The CB craze of the '70s is long-gone. Unfortunately, the interest in illegal CB amplifiers is still with us.

The Ten-Tec Argosy

Ten-Tec got around this amplifier problem with a simple solution: the Argosy transceiver. The Argosy is capable of running up to 50 watts output on 80 through 10 meters in either CW or SSB modes. Or, it is just as happy with an output of 5 watts, again in either mode you choose. The Argosy also featured the 30 meter band, a first in a commercial QRP transceiver. Also included with the Argosy was a completely broadbanded receiver. No longer did you need to resonate the front end of the receiver like you had to do with the Argonauts. Of course, the transmitter was broadbanded too, just like the 509 and the 515 Argonauts.

The Argosy also featured a noise blanker that really worked (also a first from Ten-Tec) and a two-stage audio CW filter. Of course, you had the Ten-Tec full OSK CW system in the Argosy and PTT SSB. The Argosy did not have a VOX circuit for phone use. Both the audio filter and the noise blanker were optional to the base Argosy.

The Argosy continued the tradition of the slide-rule frequency readout Ten-Tec used since the days of the PM series. The Argosy updated the readout with a sliding LED to mark frequency while the dial skirt read out the nearest kHz. A pulsed calibrator provided a marker signal every 25 kHz. The calibrator was also an optional accessory on the Argosy.

You could also install several optional crystal filters on this transceiver. The stock filter is a rather so-so four-pole 2.7 kHz filter. The eight-pole 2.1 kHz filter proved the most popular among Argosy users, providing the ability to switch-select between two other crystal filters as well. Most people went for the 1.8 kHz filler for improved sideband performance and either a 500 Hz or 250 Hz CW filter. With all those filters in place and with the ability to operate from a battery, the Argosy became a QRPer's delight. When band conditions went into the dumpster, you could flip a switch and run 50 watts out.

The Argosy contained no microprocessors or PLL. It was completely analog, including the VFO. Of course, just like the Argonauts, touching the dial skirt of the VFO would change the frequency of the rig because of hand capacitance. Without microprocessor control, the Argosy required about 200 mA on receive. The lack of a PLL made for an extremely quiet receiver. The Argosy did lack one important feature though: an RF gain control for the front end of the receiver.

The Good Gets Better

As great as the Argosy was, it got better. Ten-Tec followed the original model with the updated Argosy II. This model incorporated features and upgrades in the receiver from the first model. Also, the Argosy II did away with the slide-rule readout. In its place is an LED display showing you the most important digits. You don't see the MHz on this display. The digital display really is nothing more than a frequency counter counting the VFO's

output. If the rig drills, you'll see it on the display. (Today's rigs monitor the CPU and not necessarily the actual frequency of the transmitter.) The Argosy II is not an Argosy with a digital readout! It is different in many ways.

The front panel layout as well as the selection of the optional crystal filters remained the same. Gone is the calibrator switch and in its place is a switch for turning off the LED display. (The light behind the meter remains on though.) The display increased the receive current to 750 mA.

Ten-Tec also improved on the noise blanker and receiver. The transmitter now has full ALC control at the 5 watt QRP setting. You can now adjust the power level (inside control) for the ALC at different settings of the power control. In my case, I have my Argosy II set for 50 watts output, but at a supply voltage of 12.5 volts. The original Argosy did not have this feature on the low power setting.

Ten-Tec also chose not to use a microprocessor in the Argosy II. Again, this makes for a very quiet receiver and low receive current. And, for reasons known only at the top, the Argosy II still lacked an RF gain control or even an ATTN switch.

Both the original and the Argosy II are still sought-after. Scan through the *Yellow Sheets* and you'll see ads every week seeking an Argosy. On the used market, be prepared to shell out about $300 to $400 for a Argosy. An Argosy II will make you dig a bit deeper, around $400 to $500, depending on filters and other options. If the Argosy series is this popular even after being discontinued, what happened?

The Ten-Tec Argosy.

Sticker Shock

The basic Argosy was cheap. But, when you started to add up all the crystal filters, noise blanker, power supply, microphone, and audio filter, it really got a bit pricey. In fact, just before Ten-Tec dropped the line, an Argosy II, fully loaded, approached $1,000. But there was to be one more nail in the coffin—the microprocessor.

At the time, hams just started to see what the microprocessor could do when custom-installed inside their rigs. Why, all of a sudden you could get PLL frequency control, TWO VFOs, memories, band scanning, memory scanning, and the list continues to this day of the bells and whistles we have all gotten used to. Ten-Tec followed soon afterward with their own microprocessor rig, the Paragon. The Omini V and Omini VI followed, with even more chores being controlled by a computer chip.

I've used my Argosy II as a test bed, contest machine, on AMTOR, CW and SSB. Yup! You'd have one helluva time getting my Argosy from me. In fact, you'll probably have to pry it out of my cold, dead fingers when I go.

Here's wishing you the best of the holiday season. Stay tuned for more project, reviews and other QRP goodies, here in the "QRP" column.

PACKET & COMPUTERS

Digital Amateur Radio

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P.O. Box 636
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Getting Started with TCP/IP, Part 4

[This is Part 4 of a series on getting started with TCP/IP over amateur radio. The series uses JNOS, a KA9Q NOS implementation as the focus, though much of the information is applicable to any variation of NOS. Non-IBM-PC users will still find the information useful, though details may vary for NOS running on your platform. If you see something that varies, and would like to share tips with other users of the machine you own, please send mail and I will pass along interesting material . . . N1EWO.]

OK, I think that most of the confusion concerning versions has been cleared up; just to be sure, here is the rundown:

We will be concentrating on two versions of JNOS: 1.07b and 1.08c. These two versions are widely distributed, though some configuration details vary. Both versions are now on the *73* BBS, though the "official" version for our purposes is 1.07b. Because of differences in details, it is quite possible that "errors" will creep into the articles in this series—that is, I may miss some differences and not spell them out. If something doesn't work with the version you are using, please try to work with it a little before assuming what you read here is wrong. If you find one of these "mistakes" please send me e-mail [jsloman@bix.com] (NOT packet mail) and let me know.

If you are using a version of JNOS other than these two I can guarantee that you will find discrepancies. This does not mean that you cannot follow along with the version that you have. I may even point out some of these if I know about them. There will be changes in syntax and feature support. If you are using a version that is 1.10x(n), where n is any number, you are using an experimental version and should expect some trouble.

The Components of JNOS

Knowing the purpose of the several files that comprise JNOS is a great way to get started. Some of these files are optional, but others must be precisely correct for the program to work at all. Let's take a look at the components and how they are used.

NOS.EXE

This is JNOS itself, the executable file that does all the work. It is, of course, not optional. The exact functionality of the executable file you have can vary quite a bit. JNOS is generally distributed as source code and compiled by the end user using a C++ compiler. If you did not compile the version you are using, you cannot be sure which pieces of code were included at compile time. The generally available .EXE files are often compiled with the 8088 switch rather than 80386. This means that it will run on 8088 (PC-XT, etc.) machines as well as 386/486 machines—though perhaps a bit slower.

AUTOEXEC.NOS

This file is the heart of JNOS configuration—the entries in this file configure JNOS at startup. This file is very much like DOS's AUTOEXEC.BAT. Entries in it are treated as command line entries when the program starts. In other words, what you put in this file is—in effect—typed at the command line. The default location is in the root directory of the drive where NOS.EXE resides. This can be changed with the proper command line switch when you start JNOS, or with an entry in NOS.CFG (we'll look at this stuff later).

There are a few essential entries in the AUTOEXEC.NOS file. These are basic configuration commands. Though it is theoretically possible for you to type these commands manually each time you start the program, it doesn't make much sense to do this—it is what AUTOEXEC.NOS is for. Let's take a first pass look at the this file to help you get started. We'll take a look in more detail later in the series.

ax25

The ax25 command sets various ax25 parameters, the same as if you were programming a TNC. Among the very first things that you must have in your AUTOEXEC.NOS file is a command like:

```
ax25 mycall  N1EWO
```

where N1EWO is, of course, your call. This sets the call for your station as far as the FCC and the rest of the packet world is concerned. The ax25 command does many other things which we will discuss later.

ATTACH

The ATTACH command attaches an *interface* to the NOS program. The most basic interface for ham radio use is a TNC connected to a serial port. The interface can be looked at from several levels. It is a serial port at the physical layer, and follows RS-232 standards. It is also a TNC in KISS (Keep It Simple, Stupid) mode. At the *network* layer, this interface is an ax25

connection, and an IP connection. At the *transport* layer the interface uses TCP and UDP—this also holds for the *session* layer. These layers are taken from the OSI network reference model. This is a generic description of networking that divides the functions required for a data network into seven "layers":

Application
Presentation
Session
Transport
Network
Datalink
Physical

This model is a tool to help think about networking. As you can see, some components may fit into more than one layer. Some networks omit some layers unnecessary for the application. If you don't follow this discussion, don't worry—it is presented for background and you don't need to understand it to make JNOS go. If you are interested in it, you will find this information discussed in depth in any good text on data networks.

Attaching any interface requires issuing an attach command with the proper command line parameters. Below is an example of attaching a KISS mode TNC to COM1: at 4800 bps:

```
attach asy  0x3f8 4 ax25 TNC0
   2048 256 4800
```

attach is the command
asy is short for asynchronous—the serial port interface
0x3f8 is the base port address for COM1:
4 is the IRQ for COM1:
ax25 specifies the interface protocol
TNC0 is the (arbitrary) name of the interface
2048 is the size—in bytes—of the buffer to allocate for this interface
256 is the MTU (Maximum Transmission Unit)—biggest packet size—in bytes
4800 is the data rate in bps

This is the structure of any attach command. JNOS supports other parameters on this command line. The first parameter, called "hardware type," supports things like Ethernet adapters and internal TNC boards. The specifics for versions and supported hardware should be found in the latest documentation for JNOS.

The second parameter, called "IO address," can be set to any valid port address, usually though it will be one of the four standard com ports:

COM1: 0x3f8
COM2: 0x2f8
COM3: 0x3e8
COM4: 0x2e8

Note that the address is specified in *hex* (hexadecimal or base 16), and is preceeded by "0x." This prefix is a convention indicating that what follows is a hex number.

The next parameter is called "vector," and is the same thing as IRQ (Interrupt ReQuest line). This is the hardware connection that is used by the port hardware to get the computer's attention when data is available. These IRQs are generally set at standard values, unless you have unusual or reconfigured hardware:

COM1: 4
COM2: 3
COM3: 4
COM4: 3

Note that ports 1 and 3 share IRQ 4, while 2 and 4 use 3—this means that ports 1 and 3 (or 2 and 4) cannot be used in pairs unless reconfigured because IRQs CANNOT BE SHARED. This is not true on MCA or EISA machines if you happen to have one, but it is the general rule. So, if you want to connect more than one TNC to your JNOS station—the software allows this easily—you will have to juggle your hardware resources to prevent conflicts.

The next parameter is called "mode" and specifies how JNOS should interact with whatever is on the other side of the serial port. In this case ax25 tells JNOS to include information to control the KISS mode TNC along with the data. Another option is SLIP (Serial Line Internet Protocol), which is designed for direct connections and so omits the TNC stuff.

Following mode is "label," an arbitrary name for the interface. This name should be representative of the interface's function on your system; it is for you—call it something that is meaningful to you.

The next parameter is "bufsize." This is the size, in bytes of the *ring buffer*, allocated for the serial port. If this number is too small, data may be lost. We'll discuss choosing the right size for this parameter later during optimization. The default of 2048 (2K) should suffice for most cases.

After bufsize is MTU. The Maximum Transmission Unit is the size of the largest data packet that your station will send on this interface. 256 is a good default value; changing this number will be discussed in the optimization section later on the series.

Finally, there is "speed" in bps (bits per second). The first consideration in setting this number is that it must match what the TNC expects on the other end of the connection. Second is the speed of your processor. The higher this number, the more interrupts to which the CPU must respond. Slower machines may lose data if the number is too high. A symptom of too high a setting is strange callsigns in the stations heard list.

Next month we'll look at other commands that you need in the AUTOEXEC.NOS file to get your station on the air. Until then, keep working to get on the air. A basic JNOS station is something you should be able to put on the air yourself. There will be three or four more parts to this series, and I'd hate to think that you would wait that long to get on the air. 73 de N1EWO.

ATV

Ham Television

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ATV in Utah

While visiting the Salt Lake City area, I had the opportunity to see two ATV repeaters in operation.

The WB7FID In-Band Machine

Built by Dale Jarvis WB7FID, this machine has been in operation since the late '70s. It has an input on 426.25 MHz and outputs on 439.25 MHz. The repeater is located on a ridge called the Point of the Mountain and is about 1,000 feet above both the Salt Lake Valley and the Utah Valley. The equipment is housed in a military surplus communications hut near a hang glider launching site (see Photo A).

Most ATV stations in the area live either in the Salt Lake area (Salt Lake Valley) to the north of the repeater or in the Provo area (Utah Valley) to the south. To cover both groups, the repeater has a pair of wide-beamwidth corner reflector antennas (horizontally polarized) on both transmit and receive that point north and south, providing a figure-eight type of pattern.

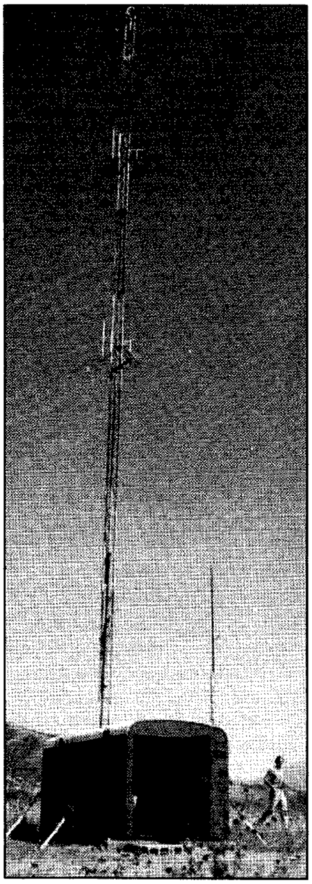

Photo A. The WB7FID ATV repeater is located in a military surplus communications hut located at the Point of the Mountain between the Salt Lake City and Utah Valleys.

About 80 watts of output power is fed into the antenna system, and after filtering and coax loss about 20 watts makes it to each antenna, providing excellent coverage into the two valleys.

From the repeater, at its vantage point on this strategic site, I was able to receive nearly P-5 signals while mobile from south of Provo, throughout the Salt Lake City area and clear up to the western edge of Ogden. The city of Odgen itself is blocked by a mountain ridge, however. Although having an output on 439.25 MHz with the input on 426.25 MHz is a reverse split from most ATV repeaters in the country, it does tend to eliminate interference to the repeater from nearby FM repeaters, remote links and packet.

The KA7OEI Crossband Repeater

Located in the radio club of the University of Utah, this system was built and designed by Clint Turner KA7OEI (see Photo C). The repeater covers most of the Salt Lake region from its vantage point 500 feet above the northeast corner of the city.

This repeater has an input on 439.25 MHz and outputs on 1248 MHz (FM ATV, audio subcarrier on 5.8 MHz). It has a horizontally-polarized corner reflector transmit antenna with about 11 dB of gain and a very broad pattern (about 100 degrees) to cover the valley. With 22 watts of output power, he gets about 150 watts ERP from the antenna after coax loss is considered.

All of the circuitry in the repeater was home-brewed by Clint, including the receive downconverter, IF system and the FM ATV transmitter and amplifier system. He even developed a circuit to take low-res VGA graphics and overlay them as an ID over the live video (see Photo B—the overlay is near the bottom of this computer screen).

The repeater frequency can be changed by remote command to 426.25 MHz and the receive antenna can also be switched from a corner reflector to a yagi. When the yagi is switched in, Clint's repeater can receive the output of the WB7FID repeater and link it out on 1248 MHz FM to help fill in some parts of the Salt Lake City area that are shielded from the WB7FID machine.

A number of local ATVers are successfully viewing the KA7OEI repeater on surplus satellite TV receivers (TVRO) using an inexpensive downverter for 1248 MHz that Clint designed.

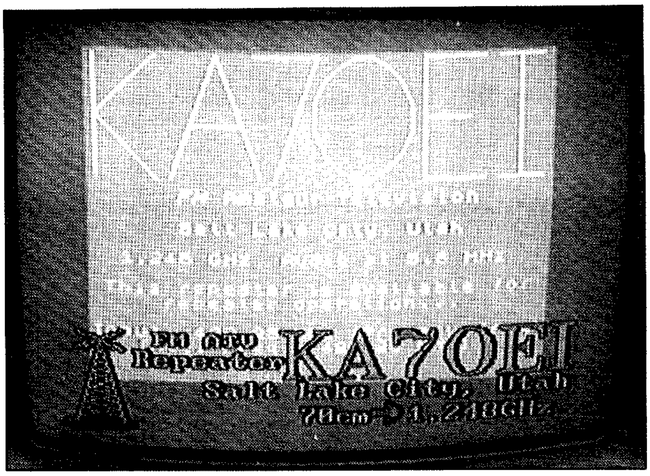

Photo B. The computer ID screen of the KA7OEI crossband ATV repeater.

SLC Activity

There are a number of active stations who work through the repeaters. A few of the more active ATVers I watched during my visit were Dale Jarvis WB7FID, Paul Larson WA7PXD, Clint Turner KA7OEI, Dave AA7IZ and Glen WA7X.

If you're passing through the area, give a call on 145.74 MHz (the local ATV calling frequency). Also check out the repeater outputs during any shuttle mission as they rebroadcast the NASA select video during most flights.

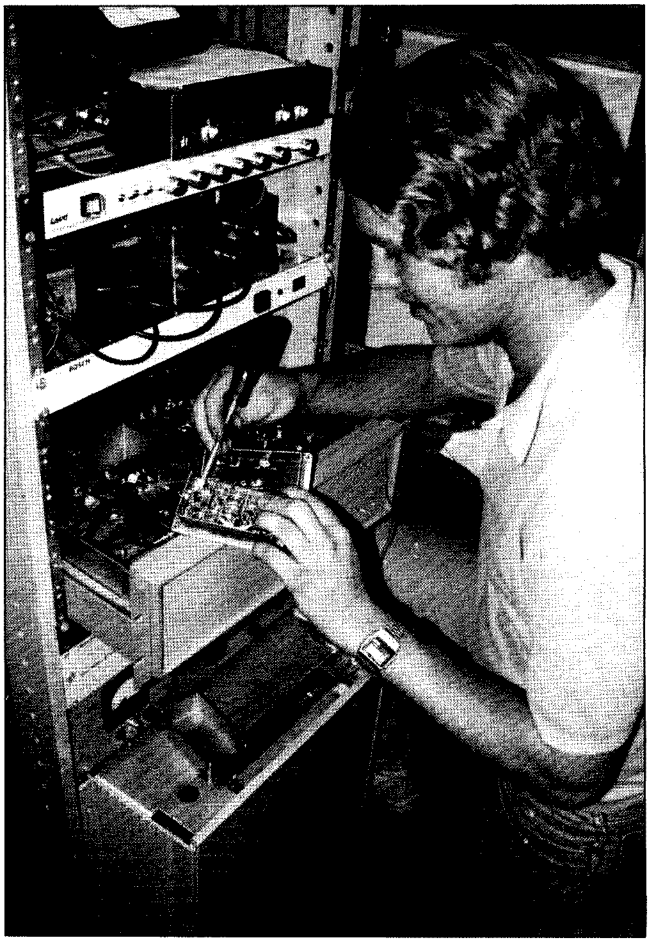

Photo C. Clint Turner KA7OEI makes an adjustment to his crossband ATV repeater located in the radio club of the University of Utah.

Number 20 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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Construction and Workbench Practices

The ARRL 10 GHz contest first weekend is over and time is running out for getting our equipment ready for the next weekend contest operation period. This brings to mind the many gremlins that crept in while operating on 10 GHz during this contest. I know what my problems are, and I thought I would describe some of them to aid you in your Field-Day-type operations. Also, this is a time to dust off some of those projects that have been collecting dust in the "pick-up-and-hold" bin. I have so many projects in this category that they could absorb all my "winter" time.

Projects that I have on hold include a DSP system for IBM computer operation using Qualcomm system components, my 6 GHz SSB system, a new bias power supply for GaAs FET amplifiers (described this month), and a switch mode power supply system for portable operations. There's no rest for those afflicted with that swap-meet disease called pickup'itus!

A Builder's Confession

First, I would like to offer a little confession: I am not a perfectionist but rather a constructor who never really finishes anything. Most of my projects are in a constant state of flux. My basic premise is "Microwave Building Blocks," so most projects can be or are constructed with a building-block modular concept. Almost all of these have a coaxial patch cord interconnection between modules. This construction method describes most of the microwave systems and converters used today. Those modules that are not located through surplus or commercial sources are home-brewed. My main concern trying to stretch a buck as far as it will go.

Using this reasoning, a converter is the only viable way I have of placing equipment on microwave frequencies above 1296 MHz. That way I can stay on budget. This modular equipment, a mix and match of commercial equipment, can be interfaced with my home-brewed modules which cannot be picked up in surplus. In this way I can construct a system package inexpensively, reaping the financial rewards and having few drawbacks compared to a full commercial system, especially for the non-perfectionist. True, the results might not look as good as a full commercial system, but I have been very satisfied with many such converters in the past.

Solving Field Day Problems

One drawback on my part in home-brew construction is not being thorough in the construction and testing of the system. Little things can have devastating effects. This is a little like ratting on oneself, but the trouble is a common one and I think it bears some mentioning. Let me start out by describing my troubles during Field Day operations and their resolutions.

One problem I had was a simple one for the workbench, but in the field proved to be nearly fatal as far as system operation was concerned, since I was 200 miles from the home workbench. What happened was that I broke a solder connection between my RF-operated switching circuit and the rec/transmit coaxial connection to the IF radio (circuitry from my October '93 column). Without this connection I could not transmit during the first weekend portion of the ARRL 10 GHz contest. Despite a shakedown test for the equipment on Saturday, I didn't discover the problem until I was 200 miles from home. The shakedown was to be a precursor to the trip north to operate from the northern Los Angeles sector, above Santa Barbara. We discovered the station trouble when we arrived at our northern-most location for Sunday's operation. What can be done on a sandy beach 200 miles from the home workbench, without proper repair repair facilities?

At first evaluation, the situation seemed hopeless. What had broken was a simple coupling capacitor picking off RF for the RF detect rec/trans switch circuitry. It was locked in receive; transmit was dead. The TX switching circuit was all automatic and the relays that operate on detected RF were not functioning. Further complicating the situation was the fact that the equipment was located in the bed of a pickup truck, and I was in the cab for normal remote operation.

This calamity certainly upset my operating prospects. Taking inventory of the situation, I discovered that the capacitor that had broken off was subject to strain on the device; that was my mistake during installation. (I was still using the proto-wired circuit constructed dead-bug style and without a PC board). A long trip for mobile operations could have been averted if I had taken a little longer to install the capacitor without strain between its leads. Repair would have been very simple with a soldering iron, but with none at hand what could I do? I tried to form the very small leads together with part of the circuit to insert the broken capacitor onto the two points of connection and let gravity assist the operation. This would be flimsy at best, and it didn't work. Just then I remembered the pack of Radio Shack clip leads that I had just purchased and pulled them out. Now the clip leads were about 16" long and definitely not suitable for RF work. However, by cutting the wire away from the alligator clip I was able to use two clips to clip the capacitor in place.

This was sort of like using a clothespin to hold things together. I left the insulation on the clip lead and it worked well. What a blessing to have the clip leads on hand! They were pur-

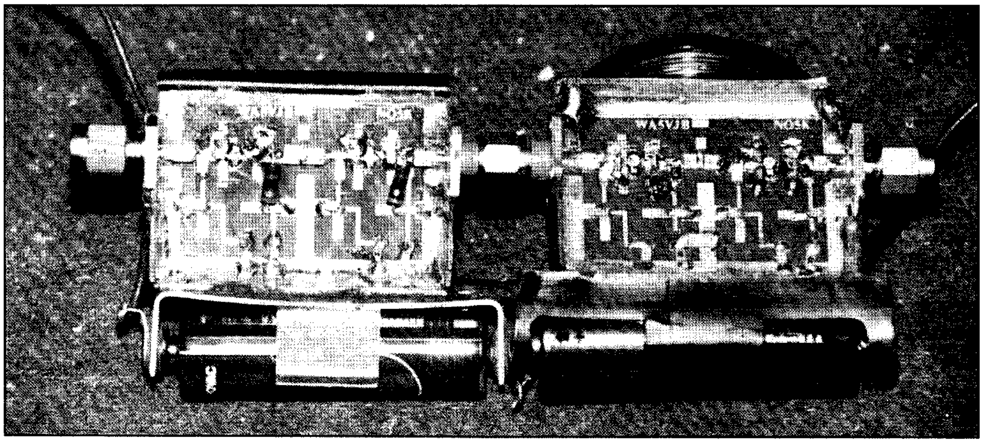

Photo A. The simplest bias supply is a 1-1/2 volt battery for negative DC bias. (WA5VJB photo.)

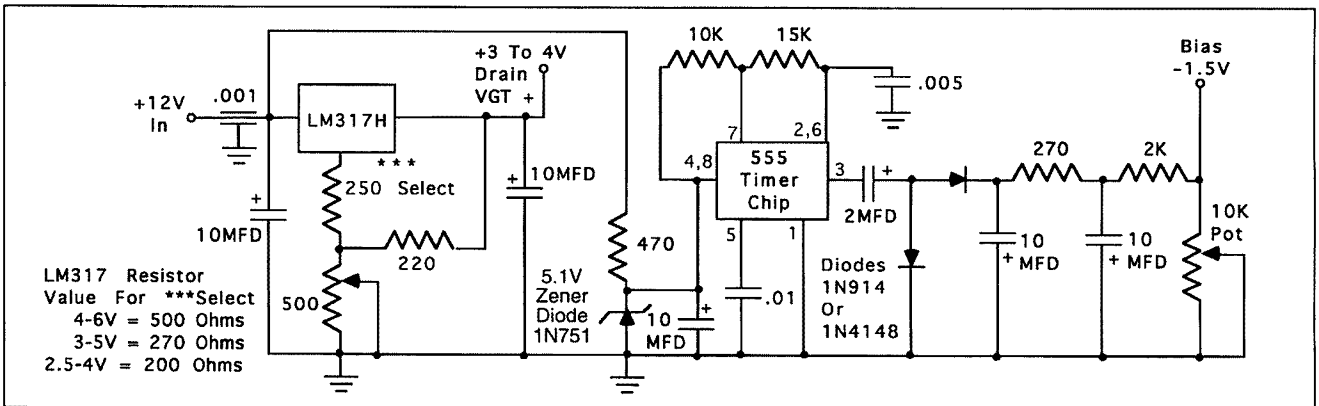

*Figure 1. Schematic for bias power supply. Adjust positive voltage with selection of LM317 resistor as indicated by ***. Note: 470 ohm resistor at the imput of the 555 chip (pins 4 & 8) is mounted on the PC board to +12 volts. This maintains a stiff -1.5 volts bias output at minimum pot output from the negative bias supply.*

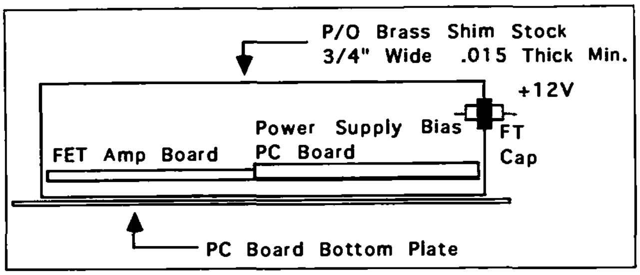

Figure 2. Amplifier container construction. Solder the bottom of the PC boards to brass shim stock sides. Solder amp PC board and bias PC power supply board together. Locate the holes for coaxial connectors for the amp and feedthrough cap for the power supply before soldering the boards together. Use aluminum foil or copper foil for the top of the container.

chased on the spur of the moment at Radio Shack when I picked up a new catalog. Radio Shack now charges for catalogs but with each catalog comes a coupon good for the catalog price on your next purchase. The coupon is what purchased the clip leads. Lucky for me, to say the least. Am I ratting on myself? Yes, but the point is that when we operate In the field unexpected things can and will happen. The thing to do is to attempt to be prepared. In this case a quick connection broke under stress. Unfortunately it took me about 30 minutes of fiddling with the capacitor and clip leads to make field repairs.

Clearly, some portable repair equipment might be in order. However, a better approach would be to be more careful in test and assembly. This is where my original problem took root, especially using the prototype PC board which was constructed deadbug fashion. I should have potted the midair connections in silicon to give some rigidity. To prevent similar problems In your equipment, use careful construction techniques and test each connection carefully. A little preparation at this level of test and construction can save much grief later when it can pop up and be difficult to spot.

I don't know just how the original soldering job looked because I destroyed much of the connection by positioning the clips. Each solder joint should be *made* by heating the connection prior to applying solder to the junction. Many of us apply a glob of solder to wet the contact and let the metal flow before removing the iron. With this type of conection between solder and contact, the chance of a rosin connection or poor electrical connection is great. Soldering each connection by letting the parts reach temperature and allowing solder to flow, still applying a little heat, would further ensure good adhesion and solderability. So much for a parts junkie. At least I plan to take a portable soldering iron along as part of the field equipment in the future. I obtained a temperature-controlled handle and heating element Weller WTCP type unit and the heating element was good. I married the cord to a pair of clip leads as the element is made to operate from 24 volts AC. My portable station runs *on* 24 volts DC so the iron won't know the difference if it gets the call for action.

Repair of the circuitry couldn't have come at a better time as our best 10 GHz distance contact was just about to happen: Jack XE2/N6XQ operating in Mexico, just short of 1,000 km south of our position—an all over-the-water shot. My partner Kerry N6IZW worked him first just as I was getting everything back in order. I made the contact with Jack and the quality was so good we carried on a conversation for a few minutes. I never thought that my day would be saved by Radio Shack, but it was. This is the longest contact I have ever made on 10 GHz SSB, and without the lowly clip cords it would not have been. Our contact was a formidable distance but there were West Coast record shots from others to come.

Conditions that day were excellent. Kerry and I worked Jack N6XQ/XE2 for a distance of 586 miles—not bad considering we were tired of driving from San Diego to north of Santa Barbara. We've got to thank Jack for his dedication In making the trip to Mexico for the contest: his was quite a long trip. (I'll get some of his experiences for a later column.) It would have been nice to be included in the record shot but we were tired after several hours of driving and wanted to set up operations before 9 a.m. I am very satisfied that Kerry and I were both able to make *any* contact at all with Jack, considering the equipment difficulties I experienced. Kerry and I run very similar rigs, both 10W TWT transmitters and receivers in the 3 dB system noise figure range with 30"-off-center feed dishes.

This record shot was preceeded on Saturday, August 22, by a contact that qualified for the record books, if only for a day. Chip N6CA, Dave WA6CGR, and Gordon WB6YLI worked Jack from Refugio Pass near Santa Barbara, California, to Jack XE2/N6XQ at the same location. The distance for this contact was 613 miles.

A new North American record on 10 GHz was made on Sunday, August 23, 1993, by Dave Glawson WA6CGR, operating out of Point Sur, California, and Jack N6XQ/XE2, located at Vizcaino Peninsula in Baja California. The distance covered on this single-hop microwave contact was 632.86 miles, for a new North American 10 GHz record. Jack was running his 3 watt home-brew transceiver and 30" dish. Dave was using his converted MA/COM transceiver with 1.25 watts and a 27" dish. Receiver performance was similar, with about a 3 dB noise figure on either end. Quite a microwave shot (single hop), to say the least. Congratulations to all!

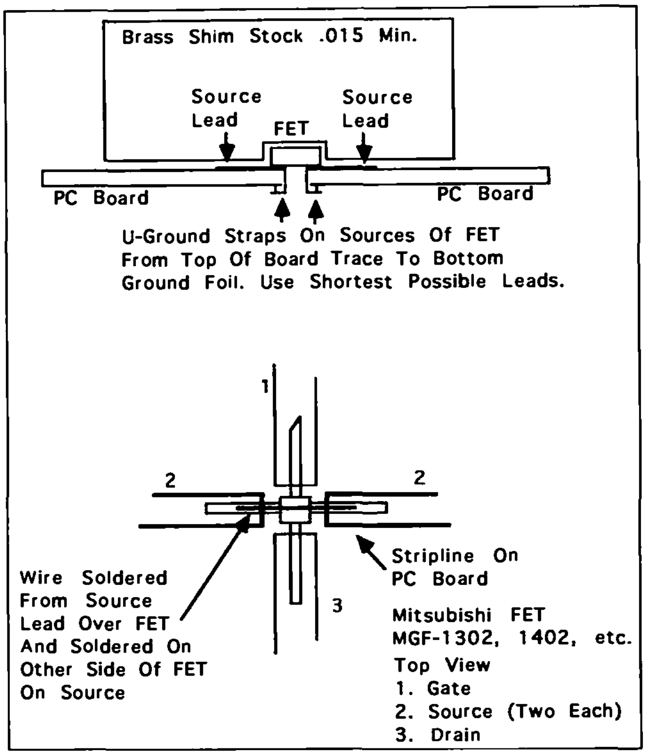

Figure 3. FET shielding details.

Construction Projects

I thought I would include the data on one of the projects that I wrapped up recently. It's a neat little bias power supply for GaAs FET amplifiers. I constructed this one due the expense ($2) of the ICL-7660 chip that I have used in the past. In its place I substituted a more common 555 timer chip ($0.45). It requires more component parts, but at least they are common and easier to obtain. See Figure 1 for the schematic details and Figure 4 for the PC board layout and parts placement. I made the power supply small so it would coexist in the same enclosure with the RF preamp for packaging simplicity. A simple modification would be to add a second bias pot should you wish to use this board in a dual-stage application. I presented such an amplifier last month, shown as a dual-stage MGF-1402 preamplifier with a dual-bias supply.

The bias supply was used this way to overcome the use of several connection leads. The use of several amplifiers or component parts of the "building block approach" was to make each unit a module with minimum leads for interconnection to the associated circuitry. Coupled with a diode for reverse voltage protection, we have a measure of self-assurance that the circuitry Is protected from abuse by not hooking up leads Incorrectly.

The two boards (amplifier and power supply) are connected by soldering

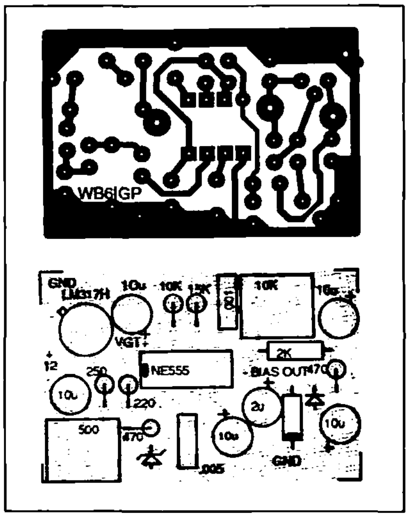

Figure 4. PC board layout and parts placement diagram. Drilled and etched PC boards are available for $3.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

the bottom ground foil of the preamp board and the bottom ground foil of the power supply together. When the boards are assembled together, bench-test the unit and complete it prior to placing it in a container. See Figure 2 for details on the brass shim stock container. The basic PC board arrangement is not strong by itself so it is beefed up by the brass stock to form a container. To add the box and strength to the PC boards, we shape brass around the PC boards to form our container sides for the amp and power supply. I use 3/4"-wide shim stock that is about 0.015" thick. This brass stock is available in most hobby shops.

Before soldering the brass sides to the boards, locate the RF connector holes and drill them to fit the board and solder together. I use SMA connectors for almost all RF work as they match the size of the amplifier closely. When the brass stock is soldered to the PC boards the amplifier and power supply as a unit is quite rigid. In the units that I have constructed I connect the coaxial connectors to the PC board prior to assembly in the brass enclosure. I drill the holes to clear the connectors and wrap the brass stock around the PC board with the power supply attached. After I have fashioned the entire piece of brass, formed to clear the connectors and having a hole for the feed-through capacitor to be mounted last, I solder the unit together using a small bench vise to hold the bent sections together for soldering.

True, this type of container does not hold a candle to a commercially fabricated unit, but it will do the same trick: provide shielding. I position the PC board sides up about 3/16" from the bottom of the brass to clear the power supply and amplifier leads. The bottom can be soldered to another brass sheet or PC board stock to close off and shield the bottom of the amp. The top can be shielded by formed tin foil for testing. A stiffer copper or other metal foil can be used in the final version.

A few tricks might be in order concerning the stability of microwave amplifiers, particularly when located inside of boxes. The boxes can act like waveguide and make a good amp unstable when placed in the box. The box looks like a section of resonant waveguide. There are several methods to stabilize amplifiers built this way. One is to add a small brass shim plate over the FET, effectively shielding the input of the FET from the output (this also breaks up the waveguide effect). See Figure 3, FET shielding. This shield is soldered to the common source leads and common ground like a brick wall over a freeway. A small slot to clear the FET connections is cut into the wall for FET clearance. Additionally, a short piece of insulated wire is placed over the FET and soldered on each side of the FET to each source lead (source leads are grounded).

Another trick is to place static foam over the power supply amplifier on top of the component parts. It can touch the components as its resistance is quite high; in the 100k or megohm range. If this works, but not really effectively, you need to take a drastic last step that is just short of black magic. What you do here is find some broken ferrite cores or broken ferrite material and glue an irregular pattern of them onto a lid or top plate on the enclosure. This will break up the waveguide syndrome inside the box. You might get by with only one of these methods or you might have to use all of them together. It's a little "cut and try." Nothing is guaranteed. Remember: As microwave FETs are used at lower frequencies their gain becomes quite large and stability is an increasing problem. Good luck with your amps, may they all be stable.

That's it for this month. As always, I will be glad to answer questions concerning VHF-to-microwave topics. Please include an SASE for prompt reply. 73 Chuck WB6IGP

Number 21 on your Feedback card

ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM
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The Essential Element

Over the nearly five years I've been writing this column, I've tried to cover just about every facet of our radios' innards, in the hope that I might help you fix and understand your ham gear a little better. We've looked at RF, IF and AF stages, microprocessors, the art of reading schematics, and more basic stuff like Ohm's Law and scientific notation of parts values.

In order to follow a schematic and make sense of the circuit's stages, though, it is vital that you understand the operation of the essential element that is at the heart of virtually everything electronic: the transistor. Now, I'm not saying that you need to understand it at the "holes and carriers" physics level. In fact, you don't need to know that at all. What you do need to know, though, is how a transistor operates in the real world. If you can see how changes in the signal to the transistor's base affect the flow of current across the collector and emitter, you can go a long way toward understanding why circuits are wired the way they are. Also, you're much more apt to recognize performance problems when you see them. So, let's take a look at the most basic, common active element in any circuit: the bipolar transistor, so called because of its two polarity-enhanced types of semiconductor material.

It Takes All Kinds

There are two basic kinds of bipolar transistors: NPN and PNP. These designations refer to the voltage polarities in the chemical "doping" of the semiconductor material, and are related to the polarities you must place on the three terminals in order to make the device work. Those terminals are named Emitter, Base and Collector. Take a look at Figure 1 to see how they're shown schematically. If the arrow on the emitter faces outward, the transistor is NPN. If it goes in, toward the center line, the part is PNP.

The important letter is the middle one, because it specifies what polarity must be placed on the base, relative to the emitter, to turn the transistor on. Notice that this polarity is strictly relative to the voltage on the emitter; the transistor has no idea where true ground in the circuit is. It only responds to what is connected to it. That has important implications, as we'll see later on.

Keeping Current

Bipolar transistors are called "current-operated" devices, while FETs (field-effect transistors) are known as "voltage-operated" components. It's a confusing terminology with a fairly straightforward explanation. Look at Figure 2 and you'll see that the internal construction of the transistor is very similar to that of two diodes. Current can flow between the base and emitter, and between the collector and the emitter, but never between the base and collector. So why not just use two diodes? Well, the magic of the transistor that makes it useful is that the diode between the collector and emitter only conducts when current is flowing between the *base* and the emitter! And, it takes only a small current between B and E to create a path for a much larger current from C to E. And that's why transistors have gain.

Regarding the current vs. voltage operation issue, take another look at that B-to-E junction. It's just a diode, right? There are two things about diodes that are important here. First, they are low-impedance devices. Second, they have a fixed voltage drop—they are not simply resistors. The voltage drop across a silicon diode is about 0.6 volts. So, if you apply more than that, the diode conducts until there's just 0.6 volts across it. The result is that signals applied to the base of a transistor look like they're getting chopped off to a 0.6 volt level (assuming the emitter is connected to ground—remember, the 0.6 volts is only relative to the emitter). So, what good is that? Well, the *current* flowing through the diode will vary as the incoming signal's voltage fluctuates, and it's that current which adjusts the conductance of the C-to-E diode. And that's why bipolar transistors are known as current-operated devices.

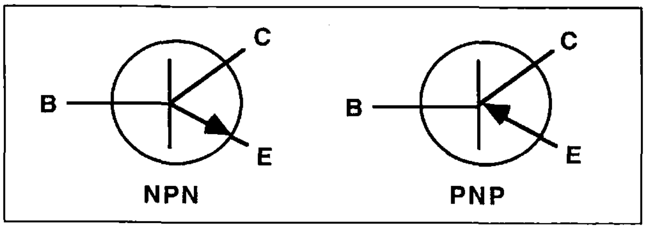

Figure 1. Schematic symbols for NPN and PNP transistors. Note the arrow's direction for each.

FETs operate on very different principles, because there's no diode between a FET's gate (its equivalent of a base) and the rest of the transistor. The "junction" is more like a capacitor. FETs have extremely high input impedances, so the input current is negligible. The voltage of the incoming signal is what affects the FET's conductance, so they are "voltage-operated" devices.

NPN

By far, the most common polarity of transistors is the NPN. It has become so for two reasons. First, most circuitry made today uses negative ground, and the NPN architecture works well in that configuration because it implies positive signals on the base. Second, NPN devices are easier and cheaper to make.

In an NPN transistor, the base must go positive with respect to the emitter for the C-to-E junction to turn on. So, in a normal negative-ground circuit, the emitter will be found connected to ground, either directly or through a resistor, transformer coil or other DC path. (There may also be a capacitor in parallel with the resistor, in order to lower the impedance and increase the gain at the signal frequency, but that doesn't affect the DC performance.) The collector will be connected to the positive power supply. Again, a resistor may or may not be present. There must be a resistance, though, in *one* of the two lines (E or C) or the transistor will attempt to dissipate the entire power supply and be destroyed!

Take a look at Figure 3. When the transistor is turned on by a positive signal at the base, it looks, as far as C and E are concerned, like a potentiometer whose wiper is being wiggled by the incoming signal. Current flows between C and E, and the resistance to it varies with the current flowing between B and E. If we take our output from Point 2, it will be a faithful replica of the input signal, except that the much larger current from the power supply will be available. That's called *current amplification*. And, because the emitter's signal follows that of the base, the circuit is called an *emitter follower*.

If we take the output from Point 1, though, it's a very different story. Now, the circuit looks like two resistors in series, the two being the top one, and the transistor itself plus the bottom one. Thinking back to Ohm's Law, you can see that, as the resistance ratio between the two varies greatly, the voltage at Point 1 will swing just about all the way from ground to the full supply voltage. In fact, the signal will *invert*; as the current between B and E rises, the voltage at Point 1 will go down! And, as the base current falls, the voltage at Point 1 will go up because it isn't being pulled down to ground by the transistor. So, the output signal will be upside down, but its total voltage swing will be much bigger than that of the original input signal. That's called *voltage amplification.*

PNP

In a PNP transistor the operation is exactly the same, except that all the polarities will be reversed. PNP transistors are commonly used as positive power switches. In that application, the emitter is connected to the positive power supply, and a resistor is placed between B and E (see Figure 4). That keeps B at the same voltage as E, so no current flows between them and the transistor is kept off. When B is pulled down toward ground by an external signal, though, it is now negative *with respect to the emitter* and the transistor turns on, allowing current to flow between C and E. You'll often see this configuration in circuits which need to be turned on and off from a microprocessor or signal processing chip. A good example is the audio amp on a handheld. When the squelch is closed, the transistor is kept off and the audio amp chip gets no power. When a signal is received, the squelch circuit pulls down the base and current flows through the transistor to the amp chip. If you suspect a malfunction in such a circuit, check the voltage between E and B, not from B to ground. If it's very close to zero, the transistor is not being turned on. If the base is negative, though, it should be turning on. If there's still no voltage on C, the transistor may be open. Because they often carry significant current, transistors in this application tend to blow more often than others.

Testing, Testing

You can test a bipolar transistor with an ohmmeter, as long as the part is out of circuit. For an NPN device,

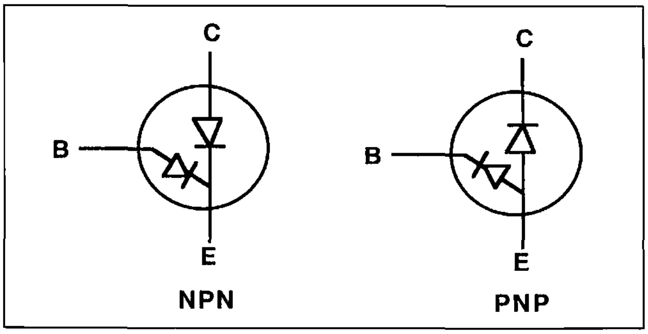

Figure 2. Theoretical NPN and PNP transistors, each composed of two diodes.

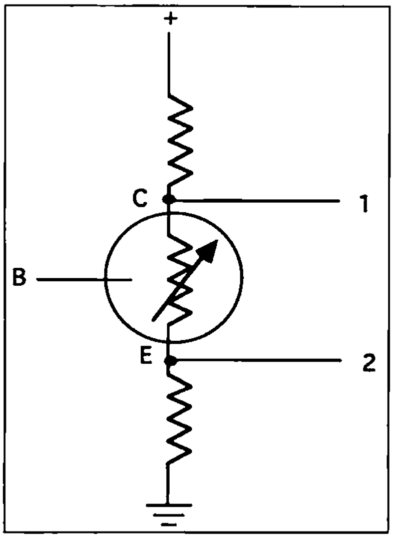

Figure 3. Another theoretical model for a transistor is composed of resistors. This model is like a potentiometer with the base-fed signal wiggling the wiper.

connect the positive lead to C and the negative one to E. With B touching E, no current should flow. Now touch B to C and the transistor should conduct. It is normal for it to have significant resistance. (If you can't get a reading, try reversing the ohmmeter leads; some ohmmeters are wired backwards.) For a PNP part, the procedure is the same, except the ohmmeter leads must be reversed from whichever arrangement works for NPNs. Once you get it straightened out, this method makes a great way to tell PNPs from NPNs.

If switching the base lead back and forth from E to C doesn't produce the desired effect, the part is probably bad. There are other problems which can occur, but this procedure will catch the vast majority of bad bipolars. Two warnings: First, be sure the transistor you wish to test is, in fact, bipolar, because you can ruin an FET that way. Second, use the lowest ohms scale that will give a readable indication, so that you don't pump too much current through the transistor. But remember, you're fighting a 0.6 volt drop, so you can't test with a nearly dead battery in your ohmmeter.

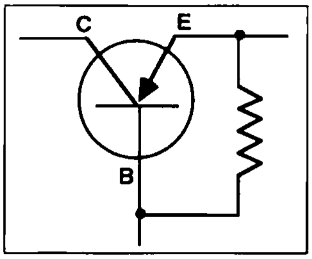

Figure 4. A common configuation for a PNP transistor includes a resistor connecting the emitter to the base.

Exploring the Unknown

Now that you know how a transistor is connected, you can figure out whether an unknown transistor is PNP or NPN, as long as you can figure out which lead is the emitter, without even taking it off the board. (If the case isn't marked, figure the leftmost lead, with the flat of the case facing you and the leads going down, will be the emitter. Now and then it may not be, but it usually is.) Here's how: If E is connected to ground, through a resistor, transformer or other DC path, then the part is probably NPN. If, however, E goes toward the positive power supply, then most likely it's a PNP part.

Well, I hope you've enjoyed our little journey through the world of the bipolar transistor. Remember, even though you can't see 'em, microscopic transistors are the essential elements of ICs too. Analyzing ICs, though, is much different and much harder, because there are lots of transistors on one chip and they may be connected in complex ways. But the principles of their operation are much the same.

Until next time, 73 de KB1UM.

73 INTERNATIONAL

Number 22 on your Feedback card

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Notes from FN42

As I mentioned last month, the Crotched Mountain Rehabilitation Center has some new hams. Chris NØCUH sent me their names and callsigns. Three of the four new hams are on packet and I'm sure that they would love to receive packet messages from around the world. Give it a go: Kristin N1POB, Skot N1PQC, and Katie N1QGP. All can be reached at WA1WOK.NH.USA. NOAM. The fourth, Gena N1PPX, is not on packet yet, but I'm sure you could get a message to this new ham if you send it to Chris at the same BBS.

Ah, the beginning of another new year! Time sure flies when you're having fun. 1993 has been a great year for me when it comes to ham radio. I was able to assist in a ham radio class for new hams, be involved in Volunteer Examiner (VE) tests that brought new hams into the hobby or helped others to upgrade, and be involved in VHF/UHF contests and Field Day with fellow hams. And I can't forget the fun of Hosstraders, a semi-annual outdoor ham flea market (the best deals happen on Friday night, or so they say). The proceeds go the the Shrine Burn Hospital in Boston. That's a great way for hams to help others and to enjoy yourself as well.

I don't know about you, but I'm looking for a bigger and better year as a ham in 1994. I hope that all of you have a great New Year as well! 73, Arnie N1BAC.

Roundup

Africa *Information from* STARS News, *Issue 1, September 1993.* **Sierra Leone:** Due to the political and economic situation, SLARS is unable to function effectively. Ham operations take place only in remote areas under special supervision from the Secretary of State. In Freetown, hams are still waiting to hear from the authorities. **Ghana:** The ban on amateur radio operations was lifted on March 19, 1993. On March 30, Kofi Jackson 9G1AJ inaugurated the station of the Merwede Hospital (Holland) in Dorma Ahenkro. **Uganda:** Also last March, the ban, imposed in the early 1970s, was lifted. In May, an American DXpedition operated as 5X1DX. **Kenya:** After the one at the Kisumu Academy, RSK started another school project, this time in Nairobi. Novice and Intermediate licenses have been introduced. **Tanzania:** Three SWLs passed their exams and are now working towards their CW, coached by Max 5Z5MR. **Lesotho:** Six new licensees are regularly operating the PADC (Promoting Amateur Radio in Developing Countries)-sponsored club station (7P8NUL). The new Radio Management Bureau, headed by Mr. Mandoro, invited LARS to advise on amateur radio matters. Various items have already been discussed, such as the RAE and the possibility of a Novice license. **Swaziland:** The training courses at Sisekelo High School generated 13 new licensees; on April 30, the club station participated in SAREX. Four students actually spoke to the space shuttle, causing tremendous enthusiasm around them (other students and parents were watching). Courses for a full license are in progress. Approaches are being made to have the South African exam be written in Mbabane. **Mozambique:** The PADC club station has been installed in Maputo. They are running CW courses. The club is working on its constitution and will soon apply for IARU membership. **Zambia:** RSZ held an AGM last May. Out of 40 licensees, eight showed up, along with two representatives from the licensing authority. Chris Cotton 9J2CP was elected chairman and Fred Bunce 9J2FB secretary. **Zimbabwe:** ZARS has a new president, Howard Kramer Z21EK.

Photo B. Operation from Quemoy (R-L): Tim Chen, BV2A; Chen Chang-yee, PTD, MOC; Joe Chen BV2IJ.

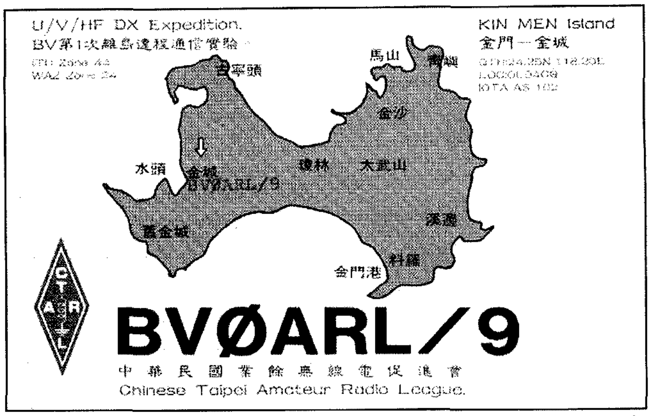

Photo A. QSL card from the DX Expedition to Quemoy Island in December 1992.

They have set up a club station at the university with two licensed members and 20 students.

"News Focus Africa" is a weekly feature in the "Amateur Radio Mirror International" broadcast every Sunday by ZS6TJ at 0800 UTC on 7.080, 14.282, 14.292 MHz (and on 7.093 in AM) and repeated on Monday at 1800 UTC on 3.718 and 14.282 MHz (and on 7.093 in AM). Tune in and let'm have your news and info. Africa Telecom 94 will be held in Cairo from April 25-29, 1994.

If you like the information presented here, you can cut out the middle man (*73*) and receive your own copy of the *STARS News* by contacting: Hans Welens ON6WQ, Mechelsesteenweg 45, B-2500 Lier, Belgium (Tel: +32.3.4891333 or Fax: +32.3.4881357). *[A full list of members of the STARS Working Group is available in the "73 International" area of the 73 BBS (603-924-9343, 300-2400 bps, 8-N-1).—Arnie]*

The Netherlands *On Target* is the newsletter from Radio Netherlands. It carries information on the programme line-up and the personalities involved. If you have comments, *On Target* has opened many channels of communications. You can send electronic messages concerning their English programmes through FIDONET, Internet, and CompuServe. Just route the message via MCI Mail to Jonathan Marks, account number 338-2983. You can phone the Radio Netherlands answerline on +31 35 724222 (24 hours a day). They also welcome your letters sent to English Section, Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, The Netherlands. You can also fax them on +31 35 724352, but please mark the fax for the attention of the English Department. If you live in the Indian Subcontinent, write to them at English Section, Radio Netherlands, P.O. Box 5257, Chanakya Puri Post Office, New Delhi 110021, India. Those letters will then be forwarded.

U.S.A. *Letter from Sociedad Internacional de Radio Aficionados (SIRA): Once again, the Miami-based Sociedad Internacional de Radio Aficionados (SIRA), or International Society of Amateur Radio Operators, performed an outstanding public service before and after Hurricane Gert slammed into the Atlantic coast of Nicaragua. The WB4ESB SIRA NCS was activated on September 14 at 9:30 p.m. EDT on 14.153 MHz and was active 18 hours a day through September 21 at 10:30 p.m. EDT. Relief communications were also handled with many Panamanian, Guatemalan, San Salvadorean, Honduran, Costa Rican, Nicaraguan, and Mexican stations.*

Several countries participated during the eight consecutive days that WB4ESB was translating all bulletins issued by the National Hurricane Center (NHC) in Coral Gables, Florida, into Spanish. The SIRA NCS started instructing other amateurs and radio clubs about the possibilities of surges, mudslides, tidal waves, flash floods, and overflowing rivers.

Also, SIRA managed to get two meteorologists, Lazaro Dominguez from WLTV-23 and Felix de la Osa WB4DLY from the NHC, to talk with several officers and personnel from Civil Defense in various countries, in order to make them aware of the danger of flash floods and complete evacuation procedures. Gert's torrential rain prediction, 5-10 inches (and more in the high regions), was a huge threat for all the Central American countries.

WB4ESB was managed in Miami by Rafael Estevez WA4ZZG, Marta Estevez KB4AW, Sebastian Jaime WB4LZR, Valeriano Builes HK4BTV/W4, Roberto Fernandez WB4RDD, and Jorge Quintero WD4JVN. The SIRA NCSs in other countries were Jose Alvarez TG9MP, Pietro Lunanuova YV4WR, Luis Peralta TI2LFP, Jaime Policart HP1MP, Cesar Landaeta YV5ID, and Rafael Garcia HI8RGO.

Our thanks to the many other stations who acted as relays and kept the nearby frequencies clear. As usual, 7.163 MHz was also used late at night and early in the morning to continue the communications with some countries, due to the short skip.

With so many hours of prevention, the sad part of this story is that more than 15,000 people were left homeless and a total of 59 were dead in four countries (TI, YN, HR, XE). Merciless Gert was another hurricane killer

Continued on page 82

73 INTERNATIONAL

Continued from page 80

sweeping through Central America and Mexico.

Beyond differences of language, nationality, religion, and/or political systems, SIRA again achieved the goals defined in its motto—"Fomentamos la Hermandad y La Buena Voluntad," "We Enhance Brotherhood and Goodwill."

For further information about SIRA, please write, call, or fax SIRA's president: Rafael M. Estevez WA4ZZG, P.O. Box 524071, Miami Fl 33152-4071; (305) 822-1688.

CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EA8
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Islas Canarias, Espana

Hello again from EA8-land. The old ham radio club of this part of the island (the northwest) is becoming active again after many years. This is the same club that fielded the ham's famous "trip around the island by burro." And foxhunting seems to finally be getting started here. They also sponsored a series of evening public talks on various aspects of our hobby during the recent September holiday celebrations in Guia. This year, I finally made the "Romeria" in typical traditional costume, camera at the ready. If a friend got a decent shot of me, I'll send it along with the next report.

Most hams at least know where the Canary Islands are located, but that's not true of the general public. They simply have no idea, and neither did we when we first started thinking about moving here in 1986! We did what research we could but learned little, and most of what we learned was either wrong or outdated. So, we found lots of surprises. Nothing could have prepared us for the incredible physical beauty of the archipelago. Another pleasant surprise was finding a varied international community. Since in the afternoons and evenings I wear the hat of a private English tutor and many of these people want their children to learn English, I'm in their homes every day. For some reason most of my students are Oriental, and anyone who has bought the myth of the "inscrutable Oriental" obviously hasn't gone to their homes to teach their children English.

I well remember arriving at one apartment to start a new class. Often they will set out a pair of slippers for you to put on when you take off your shoes. As I stopped in the entryway to take off my shoes, I glanced into the living room to meet the returning glances of the mother and her friends. Then they followed my gaze down to the slippers set out for me. My size 10-1/2s were dwarfing the size seven slippers set out for me, and they were the biggest they had. The result was uproarious laughter from all sides, adults and children alike. When it had subsided, I was enjoying it too, and the apologies called for by their high sense of courtesy were made and received through big smiles and a few lingering chuckles. The ice was broken with that family.

Another time a little Japanese girl, very well disciplined but also full of spirit, had just gotten new hand puppets. So after class, while her mother and I drank tea, she treated us to a puppet show off the edge of the table. Immediately we had a sequence of classroom pandemonium, students wrestling on the floor, teachers reprimanding those responsible, all accompanied by an ample range of sound effects and more uproarious laughter. These aren't isolated incidents, so maybe you get the idea.

As any teacher, classroom or individual, knows, you can only allow students to loosen up to the degree that they will settle back down to work when you give the word. But the learning experience can be enriched immeasurably by including such digressions. So it's really worthwhile to look for the balance point and use it to the utmost from time to time. It seems to help with my rebellious children (and I get a lot; again, I don't know why), and it's one of the acceptable ways I give them to let off some steam so that, hopefully, they won't feel they have to disobey or try to thwart me on the important points.

Until next time, 73 from Woodson, N5KVB/EA8.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel

IARC Wins Court Precedent Against Jammers After the Israel Amateur Radio Club (IARC) jammer trackers caught two pirates disrupting 2 metre and 70 cm FM repeater traffic in Tel Aviv, the organization decided to take matters into its own hands. This came as a result of dissatisfaction with the authorities' lack of action in the matter.

After the IARC promised not to file for damages against the offenders, the jammers pleaded guilty. The tactic was to gain a legal precedent in this civil case to be used in future lawsuits against jammers. The offenders were obligated to cease all operations, so the QRM was effectively squelched.

Without going into the intricacies of the verdict, the main points of the outcome are as follows:

1. The repeater frequencies "belong" to the IARC, and there is no such thing as just happening to be conducting a QSO on the repeater's

input frequency. Thus, anyone not a member of the IARC may not use the frequencies of the IARC repeaters.

2. Likewise, anyone not a licensed radio amateur may not use the frequencies exclusively designated for the amateur service, and thus may be sued. (This may sound like a redundant reiteration of the radio regulations, but bear in mind that this is a precedent-setting judgment in a *civil* court.)

3. The government attorney general set down that the police action against intentional interference was no longer contingent on a criminal complaint by the Ministry of Communications alone (the previous procedure).

The bottom line is that the victims of intentional interference are no longer dependent on the Ministry of Communications, admittedly understaffed and underbudgeted and often accused of being ineffective. Now sufficient evidence may be collected against the jammer, and the police may be called directly. How effective will this precedent be? Only time and the prosecution of the next culprit will tell.

Rich 4X1DA published a paper in the IARC magazine *HAGAL* detailing some of the methods that are used to nab jammers. Outside of Doppler and triangulation direction finding methods, every transmitter has its own characteristic "fingerprint" in terms of how it keys up each time it transmits on the frequency, and with the use of a computer it's easy to catalog everyone's "fingerprints" and then identify an unidentified transmission. This also provides solid condemning evidence. Even a repeater "kerchunker" can be identified this way.

[We ran out of room this month, but this needs to get in. As of midnight, December 31, 1993, 4X1RU HF/VHF packet BBS will go off the air due to many reasons. Full story next month.—Arnie]

MONACO

Daniel Plett 3A2LZ
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Monaco

We've had a big month here in Monaco. Maybe this will be of interest to you.

On the 15th of October, His Serene Highness, Prince Albert, was a guest of the Association des Radio-Amateurs de Monaco (A.R.M.). The A.R.M., Monaco's national amateur radio society, was celebrating 40 years of existence and the official opening of its new facilities. This location is provided by the Monagasque government. During the ceremonies, Prince Albert was awarded the callsign 3AØAG.

Representatives from French and Italian amateur organizations also attended. Representing the R.E.F. (from France) was F6AXX. F6GEZ also came, representing the Alpes-Maritime region, which surrounds Monaco. I1BYH came to represent the A.R.I. (from Italy) and presented a pennant and plaque as a show of friendships to the A.R.M.

During the week of 10-17 October, Monaco hams activated a special callsign, 3A4ØARM. This contact is worth two points for awards offered by the A.R.M. Using 2 meters to coordinate their activities, they kept the callsign active on most HF bands and on CW, SSB, and RTTY. All QSLing is being done by the association through the bureau.

Best 73, Daniel 3A2LZ.

TAIWAN

Tim Chen BV2A
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China

The Chinese Taipei Amateur Radio League (CTARL) dispatched an expedition group of 16 operators/technicians to initiate the first BV9 amateur radio—BVØARL/9—on the Quemoy Island, 320 km southwest of Taiwan, for an eight-day operation from December 24 to 31, 1992. The group arrived safely and came back to Taiwan by air transport. Owing to crowded air traffic, all persons were forced to book first-class seats at twice the expense. The total expenses, amounting to approximately US$9,000, were jointly borne by all participants. The Trimmer Company was most generous, lending all rigs and antennas for the operation. Also, we are grateful to those radio fans in Kinmen for volunteering all help: providing transportations, manpower, facilities for installing the radio station, and arrangements for accommodations. At last, these people have become our society's members.

The Deputy Director, Chen Changyee of PTD, MOC, had accompanied the group to open the ceremony on the morning of December 25th; and the Director of Quemoy Tele-Communications Directorate greeted the occasion by wishing that the amateur's activities would be further promoted in the area, where the restrictions will be lifted before long for all visitors.

The QSL cards for the expedition station BVØARL/9 are now ready and being dispatched. The participating operators were: BV2A, BV2BO, BV2FB, BV2TA, BV2AP, BV2WC, BV2DQ, BV2WC, BV2HH, BV2IJ, BV2LK, BV2QB, BV2HN, BV2UA, BV2VA, BV2ET (XYL of BV2VA, Trimmer), and BV2EW. BV2EW was at service with the military in Quemoy, and he joined the expedition unexpectedly and enjoyed it tremendously.

73 from Taiwan de Tim Chen BV2A. *[Chinese Taipei Amateur Radio League, GPO Box 93, Taipei 100, Taiwan, China]*

NEVER SAY DIE

Continued from page 4

have to break loose and think differently.

Electro-Voice was started in a garage in Ohio by two chaps I knew who thought they could make better microphones. Jim Lansing started similarly, making better loudspeakers. Steve Wozniak and Steve Jobs started in Jobs' garage with the Apple I. I visited 'em in 1976, when all they had was a handmade prototype, egged 'em on, and the rest is history. At about the same time I met Bill Gates, who'd just dropped out of Harvard. He took the BASIC interpreter he'd written as a school project and joined MITS, the first microcomputer manufacturer. He's done well.

No guts, no glory. And no nice expensive ham shacks either.

How I Spent My Summer Vacation

Last year my birthday present from Sherry was a trip to Alaska. Ketchikan. Well, I told you all about that last year . . . I can't help it if you're not paying attention. It was a great trip and you've screwed up badly if you haven't gotten up there to visit that area. You're a disappointment to me, the way you've been screwing up, despite anything I advise. I'm doing the best I can to smooth out life for you . . . plodding on ahead, pointing out the rough spots so you can avoid them. And also pointing out the points of interest, so you won't miss them as you trudge along with blinders on, looking down.

Sigh.

Hey, look up! You've somehow managed to luck into the world's finest hobby, amateur radio. Now look at what you can do with it! There are some exciting things you can do in amateur radio that you haven't tried yet. Also, there are some other things you can do that are fun. There are ways you can live a longer, healthier life. There are plenty of ways you can make money and have fun doing it.

So when are you going to look into a trip to Alaska? Or getting on packet? Or making ham satellite contacts? Or maybe doing a little DXpeditioning? It can't be a lack of money because I've been telling you how to make all the money you need for years . . . and proving it by heeding my own advice. You don't have to work hard, just smart . . . though working hard as well as smart does help.

Right after that Alaska trip last year Sherry organized a short trip to Dominica so I could get in a little scuba diving. That's when she came across a special fare that Liat (Leeward Islands Air Transport) had going. But, I told you about the diving trip last year. This year, a couple weeks before my birthday I wondered if Liat might have that fare available again.

Most Caribbean vacationers head down there in the winter, so that's high season. The place is almost empty in the summer, so prices are down in the NSD range. Those are the kind of prices I like. My hordes of detractors call me cheap. I prefer to think of it as being thrifty. They say NSD stands for Never Spend a Dollar. Well, I don't like spending a dollar where a few dimes will do the trick.

Sherry reported that yes, Liat did have a corking good fare. $360 for 30 days anywhere on the airline. She asked me for a list of the islands I hadn't yet visited so she could see what she could put together. I gave her a list of 10, figuring that she might be able to organize us visiting two or three of them since I only had a few days open on my calendar. She came up with a way we could visit all 10 islands in 21 days. We'd fly a day and then I'd dive a day, hopping from island to island. The tour included Barbados, Tobago, Grenada, St. Vincent, Guadeloupe, Antigua, Montserrat, Anguilla, Nevis, St. Kitts, plus an eight-hour layover on St. Lucia between flights. That would give me eight new ham radio countries to visit, bringing my total to 128 . . . but who's counting? The 11 flights would average only $33 each!

One thing I didn't know when I was planning the trip was that the old days of having to send ahead weeks in advance for a license were long-gone. These days most of these countries let you bring along a rig and get on the air using your call with a portable slash for a few days without any official permission. And beyond that, licensing is easy. So at the very least pack an HT. Almost every island has at least one repeater. Some have repeaters linked to other islands. Some even have packet links. Plus you might want to bring along a portable rig like a 735 and some wire dipoles. Suddenly you're on a DXpedition.

The Montserrat exhibit at Dayton this year helped pound the idea of getting down to the Caribbean into my head. It didn't hurt that VP2MAX runs a great bed and breakfast place there. Wait'll you see it! And he even included the use of his station! Though I only visited Montserrat for two days they issued me the call VP2MCD so I wouldn't have to operate as W2NSD/VP2M.

I had some great minihamfests on several of the islands. One thing is clear . . . the hams would love to have you come down, see their island, and get on the air and take some of the pileup pressure off. It's one thing to be on a DXpedition and make a few thousand contacts. It's another to live there and have most hams not wanting to talk with you, but just get your QSL. That was the main reason I went to Jordan when King Hussein first got on the air. I was afraid we'd lose him as a ham if he wasn't able to actually talk with anyone, but had to constantly fight off pileups. So I went to Amman and spent two weeks grinding down the pileups, giving His Majesty a better chance to enjoy our hobby. I didn't say I didn't have fun doing it.

If you can visit an island or two armed with a rig, you'll not only have a ball, but you'll be doing the locals a big favor. Everywhere in the world I've traveled I've found the hams in rare countries hating the pileups and the DXCC Honor Roll, which is at the root of them. They've been anxious to have me work the pileups for them, so I've handled endless pileups from all sorts of weird places such as FK8, VR2, 5W4, 7P8, 3D6, 5Z4, YK, YA, 9M, VU, OD, FO8, HS, and so on.

Okay, what does it cost to get down to the Caribbean and have some fun? American Airlines cost $330 round trip from Boston to Barbados. Plus the $360 for Liat, and an average of around $75 a night for a double room at most hotels. Plus 10% service and 7% island tax almost everywhere. Plus an exit tax of up to $20 per island. I figure it cost us about $250 per island including meals, rooms, taxis, exit tax, and some ice cream cones.

The whole trip for the two of us thus cost around $4,500, and that included two dives each on nine islands. That netted out to around $205 a day for a 22-day trip which I'll not only never forget, but which I'll probably never stop talking about. Would I do it again? In a minute!

You do have to watch out for the $350-a-night deluxe hotels. There are plenty of perfectly nice hotels and guest houses for well under $100 a night.

One warning to you red-necks: Most of the hams in the Caribbean are black. But they are so friendly and helpful that skin color soon doesn't matter. They're hams and avid about our hobby. And they're not nearly as uptight about color as are so many American blacks.

A Contest? Another Damned Contest?

Well, maybe. For over 30 years I've avoided organizing *73* contests. When I was the editor of *CQ* I got their DX contest going after Perry Ferrell had let it die. It's still going strong. Then I got a prefix contest going which may still be running. I've lost track. Those, plus the ARRL DX, Sweepstakes, and VHF contests seemed like enough. While I was talking with the Caribbean ham groups I broached the idea of a Caribbean vs. North American contest . . . maybe in August, when prices are low. The idea would be to get a bunch of America ham clubs to organize groups and put the rarer islands on the air for a contest weekend. What do you think?

Before I plunge into this I'll need three things. First, I'll need a DXer or a DX club to sponsor the contest and handle all the paperwork. I can help with getting the word around via *73* and *Radio Fun*, but I'm not going to sit here and cross-check a thousand logs. I learned my lesson on that when I ran a Save Eleven contest and got buried in logs. That was before we lost 11 meters to CB, so you know how well I learned that lesson. Are there any volunteers to officiate on a Caribbean/NA contest? Think of the international fame and recognition! Wow!

My second need will be a clear green light from the Caribbean island ham groups. This is mainly for them, so I don't want to jam anything down their throats. But if we can get a dozen or two ham club groups of six to 10 operators each down to the islands, not only will the participants have a lifetime of memories as a result, the islands will generate some badly needed revenues as well. They sure can use the extra business during the summer.

The third thing I need is an indication that you like the idea. If I don't get a lot of enthusiastic letters about this I'll deep-six it in the Cayman Trench, the deepest part of the Caribbean, some 27,500 feet deep. By the way, that was a trivia question on the flight back and worth a bottle of wine to know. The other trivia question was the degrees centigrade outside the plane . . . which I won, much to my surprise, with a guess of -38°C. And I don't drink. Oh well, the wine'll be good for cooking.

There are a bunch of islands down there, so there's room for everyone. And the Caribbean includes Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, on up to the Bahamas. There are the Greater and Lesser Antilles, and the Turks and Caicos Islands. I count around 43 countries all told . . . with 10 kinda difficult to reach and/or uninhabited.

If you like the idea let me know. I have enough to do without spinning my wheels trying to make people happy who don't want to be happy.

A Diver's Paradise

Most of you aren't into diving. Pity, because it's not an expensive sport; it's a lot of fun, and the exercise is great. Plus you get to see a lot of the world that most people miss except when Costeau or someone shows an underwater video on TV. It's wonderful being right down there with the sharks, barracuda, lobsters, moray eels, and so on . . . just floating along.

The price had recently come down on Hi-8 Sony cameras, so I got one a couple days before the trip. Then I called a diving friend to find out which underwater housing to get. He said it was the SubXero, so I called the chap in Miami who makes 'em and luckily he had one on hand. It arrived the next morning by Fed-X. It cost less to have it shipped than to pay the Florida sales tax and pick it up while passing through Miami on the way to Barbados.

The downside was its weight. I had to hand-carry it in a separate bag to keep from making my checked baggage so overweight they'd charge extra for it. It weighs a ton out of the water, but only about two ounces in.

The upside was that the videos came out marvelously. I advise you to make a wide berth around Peterborough so you don't get nailed for two or three hours watching my diving videos. Hey, look, there's the big manta ray at Tobago! And how about that

shark going by at Nevis? Plus endless coral and small, colorful fish swimming around. And look at the size of that lobster!

It was a blast and the hams were great. But next time I probably should take along an all-band rig instead of the video camera. They weigh about the same.

My luggage was filled with books to read during the trip. By the end I was busting to start two new publications . . . one about Caribbean diving, which I might call *CD Review*. And the other, as a result of the books I read while traveling, would be *Science Frontiers*. It would cover scientific research which the establishment refuses to deal with. There are some things that researchers have been verifying that are so obviously impossible that no establishment scientist or publication would dare to even consider them.

The diving publication would cover diving services, hotels, and all the other things travelers need to know when they get to a new place. How much are taxis? Where can you get good food reasonably? Should you rent a car? How good are the diving facilities? How about the coral and fish? What rip-offs should you watch out for? And so on. Visiting hams will want most of the same info. The con artists down there are waiting for the unwary at every turn, just like here in America.

More Diving?

Maybe, if I can get away. My diving friend is organizing a trip to Truk, Palau, Majuro, and Ponape for early February. I'd sure like to go. If you're interested I'll get you the details. Majuro, by coincidence, was where I started diving, back in 1944, when we stopped off there a couple of times to rest between submarine war patrols. I converted a Momsen Lung and dove around the lagoon. That's all it took to hook me on diving for life. When they invented the Aqua-Lung I bought one of the first models. By 1953 I had my own compressor and tanks.

I must warn you that I'm dangerous to travel with. I see business opportunities everywhere and get people all excited about starting this or that business. Wait'll you read some of the ideas I had for new businesses in the Caribbean islands!

If you decide to go along for the Pacific trip I'll have my video camera and get you a videotape of yourself going in and out of the Japanese fleet at Truk, plus who knows what other exciting things we'll be seeing.

And you could do worse than bring along a rig . . . right? I'll bet I'll have one. I may even write ahead for licenses this time.

Aaargh!

I'm holding in my hand an "Order For Supplies Or Services." It's a purchase order for a subscription to *73*. This is a government form we have to fill out to get paid for one subscription. "Contractor must submit four copies of invoice." This bugger is seven pages long, but at least they tell you right up front what you're up against. It says, "Public reporting burden for this collection of information is estimated to average 1 hour per response, Including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed and completing and reviewing the collection of information."

Seven pages for a $20 subscription. This is going to cost us at least $20 to fill out in quadruplicate. I hate to think how much the government will have spent paying for the one-year subscription by the time the dust has settled, the government has settled, and the paperwork is all done and filed. I'll bet they'll increase the deficit by at least $100, just on this project alone.

Poor, Naïve Wayne

One of our advertisers called the other day and asked a question. He'd exhibited at a recent *CQ Magazine* sponsored hamfest, which he says turned out to be a true turkey. He opined that not only didn't anyone much bother to attend this bomb, but those who did had their wallets sewn shut, just in case. The question he asked was a natural one. How come, in the face of this disaster, there was an article in a ham newsletter extolling the event? He wanted to know if there was something going on here that wasn't in plain view.

He further suggested that there might be a connection between the recent plea by the newsletter for money to keep afloat and this curious coloring of their reporting. I assured him that not in my wildest dreams would I ever suspect *CQ* of paying off the newsletter in order to try and salvage their floundering hamfest investment. I don't know where people get crazy ideas like that. I'm sure there's a simpler explanation for what's going on.

The Secret Life of Plants . . .

This is a fascinating book by Tompkins and Bird by Harper & Row Perennial Library ($14). If your spirit of adventure hasn't been totally wiped out by our crummy so-called educational system, you'll enjoy this. One thing about the book worried me, I have to admit. The material was first published in 1972 in *Harpers*. Then it was published in 1973 in book form, and reprinted in paperback in 1989. So why haven't I seen follow-up books on such an important subject?

Much of the stuff in this book doesn't seem possible, which was another reason for my concern over its validity. Then a friend sent me a video on the subject he taped off the air, allowing me to see some of the amazing experiments described in the book.

This all started when Cleve Baxter, a polygraph expert, connected a galvanometer to the leaf of his dracæna. He wanted to see if it would be affected when water was poured on the plant's roots. The meter's reaction wasn't what he expected. The trace zigged down instead of up, with a pattern very similar to his polygraph charts. Hmm. So Cleve decided to burn the leaf with a match and see what that would do. He was astounded to see the needle jump the instant he thought of burning the leaf. There was less of a jump when he actually burned the leaf. Could plants have some sort of extrasensory perception? You'll find the story of his research that resulted fascinating.

For instance, he found that when he had two plants together, with one wired to his galvanometer, when someone came into the lab and trashed the second plant the first reacted violently. Then later, when that person came back into the lab the plant again reacted violently. Somehow it not only was able to sense that particular person, but was able to remember the destruction of the first plant and indicate something akin to fear.

At the Hashimoto Electronics Research Center in Tokyo, Dr. Hashimoto was able to teach a plant to count and add up to 20. I saw a video of a plant being taught to manipulate a galvanometer hooked to an audio oscillator and say letters.

And how about a scientist who was experimenting with a plant root. He had it in a shielded tube so he could aim it at other plants. One day he left the chart recorder on during his lunch break with the root pointed at the sky. Suddenly he heard whistles and a series of pulsations. He moved the tube around and found the "signals" were coming from outer space, from around Ursa Major (the Big Dipper). But you'll have to read about all this.

Do trees and plants communicate with each other? Do they exhibit long-term memory? When a plant is taken away from a group can it die of loneliness? Can ultrasonic frequencies Influence the growth of seeds? Can a healer affect the growth of seeds merely by passing hands near the water used on the seeds? Can water be magnetized? Can a plant be conditioned to tell the difference between a piece of coal and a rock placed next to it?

You'll be amazed at the work done in India by Sir Jagadis Bose a hundred years ago, despite the resistance of the British Royal Society. Botanists, in particular, hated the idea that plants have a nervous system, even though Bose proved it with his experiments.

Can people really talk with plants? Luther Burbank gave his plants most of the credit for his discoveries, saying that he took them into his confidence and had learned to listen to them. Another plant listener was George Washington Carver, who invented peanut butter, plus an endless number of other peanut products. Before Carver, the peanut was considered worthless pig food.

Can music get plants to grow faster? 200 percent faster? And why do they grow toward classical music and away from rock—and then die? Well, that's my reaction too. They seem to like jazz too.

And what happens when you add some electricity to the pot when you're sprouting seeds? Would you believe the sprouts can grow five to seven times as fast? Jean Nollet demonstrated this in 1747. Of course if you want bigger and sweeter strawberries, this book may be of interest to you. How about a bean plant that grew to 22 feet high as the result of a pot being wired to an ordinary electric outlet? How about tons of seeds passed between the plates of a capacitor and then grew one third greater harvests in Italy in the 1930s? Corn yields jumped 20% in Russia in the 1960s with a similar treatment. And activated radishes double the size of the control crops?

And wait'll you read what being near a TV set or computer does to bean sprouts and rats! These are things you can test for yourself. You might want to try some beans near your linear, with a control group further away.

Then there are questions about the role of sunlight and our eyes on our behavior.

You'll enjoy reading about how Harold Burr developed a very sensitive voltmeter for studying living things. With it he could detect the exact moment of ovulation for women, detect malignancies, the rate of healing of wounds, and with seeds he could predict how healthy the resulting plant would be. With plants he could see the changes made by the lunar cycle, sunspots, and solar storms.

There's a wonderful chapter on what's been done in the scientific investigation of auras and Kirlian photography.

Another chapter shows a parallel between the birth of retarded children and the use of chemical fertilizers. Just between 1952 and 1968 the number grew by 25 times! Plus there's been a similar rise in leukemia, hepatitis, Hodgkin's disease and other degenerative diseases. It's almost enough to get you to start buying from your supermarket's organic food section. Fifty years ago coronaries were rare. Cancer, diabetes, arthritis, cavities, etc., are rapidly increasing.

Did you know that some plants and animals are able to transmute one element into another? Chickens, for instance, can change potassium, magnesium, and silicon into calcium.

It's a terrific book. If you have any curiosity at all it should have you setting up your own research projects. But I still wonder why I haven't found any books on the subject written since 1973. Weird. I'll be doing my best to get in touch with the authors to see what's been going on. I'll let you know. I'd love to see the books Bose published describing his experiments a hundred years ago.

If you know of any more recent books along this line, please let me know about them.

The research described in the book gives us strong clues on how we can greatly reduce sickness and thus cut our health care costs. It can help us grow better crops. Check it out. 73

Number 23 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our **BBS (603-924-9343)**, for listings that were too late to get into publication.*

JAN 8-9

FT. MYERS, FL A Hamfest will be held by the Fort Myers ARC, Inc., Sat. 9 AM-5 PM; Sun. 9 AM-3 PM., at Araba Shrine Temple Hall, 2010 Hanson St., (One block East of Rt. US 41). VE Exams Sat. at 1:30 PM; Sun. at 10:30 AM (no pre-registration required). Talk-in on 147.345+ MHz. Contact: *Jerry Deutscher KQ4UW, (813) 472-5130; Dale Hardin KD4UAO, (813) 275-8360*; or *G.E. Sammons WA4DQE, (813) 936-1431.*

JAN 15

HAMMOND, LA The 1994 Hammond Hamfest, sponsored by the Southeast Louisiana ARC, will be held from 9 AM-3 PM in the SLU University Center. Talk-in on 147.00-/146.52 simplex. Contact *Tyrone Burns, (504) 294-5839; or Bob Priez, (504) 542-1470*; or write to *SLARC, P.O. Box 1324, Hammond LA 70404.*

MONTEREY, CA The Naval Postgraduate School ARC will hold its 5th annual Hamfest from 8 AM-1 PM+ at the Monterey Peninsula College Armory. Talk-in on 146.97-. Contact: *Doug KC3RL, (408) 663-6117 eves/wkends; Pat KA6IRS, (408) 649-4444 Ext 20, wkdays.*

ST. JOSEPH, MO The 4th annual Northwest Missouri Winter Hamfest will be co-sponsored by the Missouri Valley ARC, Green-Hills ARC and Ray-Clay ARC. The event will be held at the Ramada Inn from 9 AM-4 PM. VE Exams. Talk-in on 146.85 and 444.925. For Dealer info, write to *Northwest Missouri Winter Hamfest, P.O. Box 182, Cameron MO 64429.*

JAN 16

MATTAPOISETT, MA An Electronic Flea Market will be held at Knights of Columbus Hall. For more details call *(508) 993-3993.*

YONKERS, NY The Metro 70 cm Network will host a Giant Electronic Flea Market at Lincoln H.S., Kneeland Ave., 9 AM-3 PM. VE Exams. Talk-in on 440.425 MHz pl 156.7; 223.760 MHz pl 67.0; 146.310 MHz; 443.350 MHz pl 156.7. For registration, call *Otto Supliski WB2SLQ, (914) 969-1053.*

JAN 22

FLINT, MI The 2nd annual Computer and Amateur Radio SWAP-N-SHOP, co-sponsored by ARAY and SW Academy RC, will be held from 8 AM-1 PM at S.W. Academy H.S., 1-69 & Hammerberg Rd. Walk-in ARRL VE Exams at 9 AM. Talk-in on 145.29-, 224.18-, and 224.14-. To reserve tables, call *Keith N8QNA, (313) 635-4123.*

LOVELAND, CO The Northern Colorado ARC will host the 1st annual Winterfest Swapmeet from 9 AM-3 PM, at the Larimer County Fairgrounds, 700 Railroad Ave. VE Exams. Computer and Radio. For VE Exams contact *Trent Hays WB0HZL, (303) 484-8315*. For general info, contact *Musser Moore AA0PB, (303) 221-3698*. Reserve tables from *Orlin Jenkins K0OJ, (303) 353-7094*. Talk-in on 145.115 (- offset, 100 Hz).

JAN 23

EAST LANCASTER, PA The Columbia Area ARC will present its annual "Dutch Country Computer and Communications Show" from 9 AM-3 PM at the Lancaster Host Resort and Conference Center, Route 30. Talk-in on 146.715-. For display and dealer info, contact *Dutch Country Computer and Communications Show, P.O. Box 682, E. Petersburg PA 17520-0682. Tel. (717) 560-2072; FAX (717) 872-0857*

JAN 29

LOCKPORT, NY The Lockport ARA will hold their annual Club Auction starting at 3 PM. Talk-in on 146.820- MHz.

SARASOTA, FL The Sarasota Co Fairgrounds, 3000 Ringling Blvd., will be the location for the Sarasota Hamfest and Computer show. The Sarasota ARA will host this event from 9 AM-5 PM. VE Exams. For general info, call *Gene Marino W1IDH, (813) 355-0675.* For tickets call *Val Lopez KC4YAY, (813) 951-1072;* or write: *Hamfest, P.O. Box 31832, Sarasota FL 34230.*

JAN 30

DOVER, OH The Tusco ARC Hamfest will be held at Ohio Nat'l Guard Armory, 2800 N. Wooster Ave., starting at 8 AM. Talk-in on 146.730 W8ZX Rptr. Contact *Howard Blind KD8KF, 6288 Echo Lake Rd. N.E., New Philadelphia OH 44663. Tel. (216) 364-5258.*

ODENTON, MD The Maryland Mobileers ARC will sponsor a Post Holiday Swapfest and Flea Market at Odenton Vol. Fire Dept. Hall, 1425 Annapolis Rd., 8 AM-2 PM. ARRL sanctioned. For VE Exams, pre-register with *Jerry Gavin NU3D, 7801 Overhill Rd., Glen Burnie MD 21060; Tel. (410) 761-1423 (anytime).* To register for tables, contact *Tom Wilkison KA3QMU, 592 Eason Dr., Severn MD 21144; Tel. (410) 969-2639 (eves.).* Talk-in on 146.205/.805.

FEB 5

ST. CATHARINES, ONTARIO, CANADA The Niagara Peninsula ARC Inc. will hold its 16th annual Big Event Hamfest at the C.A.W. Hall, 124 Bunting Rd. Write or call, *N.P.A.R.C. Inc., P.O. Box 20036, Grantham Postal Outlet, St. Catharines, Ontario L2M 7W7; Tel. (905) 937-6208.*

SPECIAL EVENT STATIONS

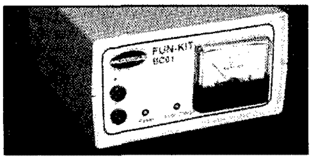
JAN 8

ST. PAUL, MN The Minnesota Frostbite Falls Beach Party, sponsored by the St. Paul RC, will be on the air from 1800Z-2400Z. Frequencies: CW - 3.540, 3.690, 7.040, 7.140, 14.040, 21.040, 28.040, 28.140; SSB - 3.850, 7.250, 14.250, 21.350, 28.350. Send logs to *Ed Van Cleave AA0HI, 2700 16th St. NW, St. Paul MN 55112; Tel. (612) 636-0108.* Please send SASE for info and sample log.

Number 24 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW



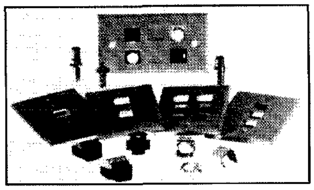
JADE PRODUCTS

Jade Products, Inc. has announced the newest members to the FUN-KIT line: the Lead-Acid/Gel-Cel Battery Charger Kits. This series of products is based on the Unitrode UC3906 battery charger chip. This smart chip is specifically designed to sense the condition of the battery and adjust the charging requirements accordingly. The charger can be left connected to the battery indefinitely, keeping the battery ready for service at all times. It can prolong the life of the battery and protect it from overcharge/undercharge damage.

These battery chargers are intended for hams who need to keep their batteries ready at all times. Applications include: repeater back-up batteries, QRP station batteries, and emergency equipment batteries.

The chargers are available in three configurations. The BC01 is a complete kit perfect for beginners. It can be built for 0.5 to 1 amp maximum charging rate. The price is $79.95. The BC02 is the same as the BC01, minus the enclosure, RFI filter module, line cord, and current meter. The price is $39.95. The BC03 is the same as the BC02, minus the power transformer. The price is $29.95.

For further information contact *Jade Products, Inc., P.O. Box 368, E. Hampstead, NH 03826; (603) 329-6995, FAX (603) 329-4499.* Or circle Reader Service No. 201.



RF INDUSTRIES

RF Industries, Ltd., has announced a truly universal (Keystone) wall plate system. These wall plates are a must for the truly well-dressed shack. They are available in standard ivory, or any other color on special order.

The plates come in 1-, 2-, 3-, and 6-hole versions. They accept 50 or 75 ohm BNC crimp, thread-on, or feed-through connectors. They will also snap mount with 4-, 6-, or 8-contact IDC modular telephone connectors. Other types are also available.

For prices and catalog information, please contact *RF Industries, Ltd, 7620 Miramar Road, San Diego, CA, 92126; (800) 233-1728.* Or circle Reader Service No. 202.

TRIPP LITE

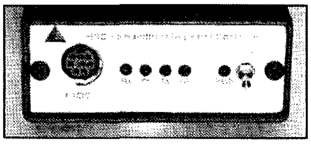
More and more amateurs are turning to digital operating modes to expand their horizions. The ISOBAR UltraFax is a premium quality combination AC and dataline surge supressor specifically designed to protect digital devices from WEFAX to MODEMs.

The UltraFAX has special diagnostic indicators to help pinpoint power and wiring problems before they can cause damage, saving both time and money. The unit is enclosed in an all metal housing with mounting tab for secure connection.

This product features the manufacturer's Lifetime Ultimate Insurance which protects both the UltraFax and the connected equipment. If either is ever damaged by a surge, TrippLite will repair or replace the unit and connected equipment free for life up to $10,000.

The UltraFAX is priced at $69.95. For more information contact *TrippLite, 500 N. Orleans, Chicago, IL, 60610-4188; (312) 329-1777, FAX (312) 644-6505.* Or circle Reader Service No. 203.

SPECTRUM ELECTRONIC PRODUCTS

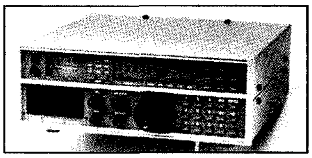


Spectrum Electronic Products has introduced the HRC-10—the world's first hand-held repeater controller. No larger than most hand-held radios, the HRC-10 converts a single or dual-band radio into a full-featured simplex or duplex repeater system. While most dual-band radios provide full duplex and crossband repeater capabilities, they lack the station ID and control functions required for legal operation as a repeater system. The HRC-10 provides an easy low-cost solution to this problem.

The unit features a voice IDer, hang time and out timers, DVOS (Digital Voice Operated Squelch), telemetry tones, and a private voice mail slot. A DTMF command interface provides remote control capabilities. The HRC-10 is ideal for emergency use, club events, and mobile installations.

For more information contact *Spectrum Electronic Products, 4740 Scotts Valley Drive, Scotts Valley, CA, 95066; (408) 438-2788, FAX (408) 438-6027.* Or contact Reader Service No. 204.

ELECTRONIC DISTRIBUTORS CORPORATION



Electronic Distributors Corporation has announced the availability of an all-new high performance HF receiver manufactured by AOR. The AR3030 has all the latest high-tech features and covers 30 kHz to 30 MHz with optional 108 to 174 MHz coverage.

This receiver uses Direct Digital Synthesis for low phase noise and synchro detection for better AM signal readability during severe fading. You can program 100 memories with direct keyboard entry. Other features include: TCXO, Carrier Operated Delay, RS232 computer control, optional filters, and power options.

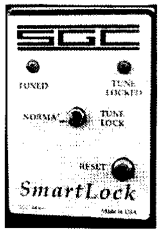
For more information visit your local dealer or contact *Electronic Distributors Corporation, 325 Mill Street, Vienna, VA, 22180; (703) 938-8105.* Or circle Reader Service No. 205.

SGC

SGC, Inc., has unveiled its new SmartLock to further enhance the severe service capability of the SG-230 Smartuner. The Smartuner is a fully automatic, microprocessor-controlled antenna coupler which covers the HF spectrum from 1.8 to 30 MHz.

The SmartLock is designed to control two antenna conditions: one where a mobile antenna is subject to violent motion which may otherwise cause the antenna coupler to automatically retune; the other to command the antenna coupler to recalculate antenna conditions at the operator's discretion.

The SmartLock may be used with SG-230 Smartuners manufactured after September 1, 1993. The SmartLock control box is priced at $59.95. Owners of earlier versions of the Smartuner, which does not have the additional control line, may upgrade to the latest version for $289 (not including SmartLock). For more information contact *SGC Inc., P.O. Box 3526, Bellevue, WA, 98009; (800) 259-7331, (206) 746-6310, FAX (206) 746-6384.* Or circle Reader Service No. 206.

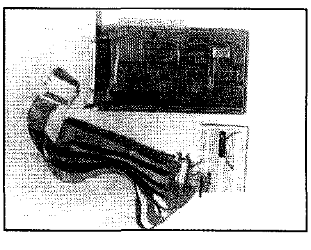


KENWOOD

This new series of HT transceivers from Kenwood has all of the things you want in a portable communications package. The TH-22AT (2 meter) and TH-42AT (450 MHz) single-band HTs offer a streamlined look, simple programming, one-touch controls, and easy menu functions.

A new innovative microprocessor and MOSFET final amplifier circuit enables a full 5 watts, while conserving battery power. A special EEPROM memory bank requires no backup battery. A wide range of accessories will also be available.

For more information, visit your local dealer or contact *Kenwood Communications Corporation, P.O. Box 22745, Long Beach, CA, 90801-5745; (310) 639-4200.*



HIGHLANDS ELECTRONICS

Highlands Electronics has announced the eBoard—a new way of developing and using an embedded computer application. An embedded computer is one which is dedicated to a task; the computer inside your microwave oven, for example. Programming embedded computers is an economical way to monitor and control a wide variety of electronic devices.

The new eBoard is a PC card which eliminates the hassle and high cost of an old-fashioned computer emulator. You work with the actual CPU from the start of your project. This works to eliminate any surprise bugs that may appear at the end of development. The low-cost board can be left in place to run the application.

The eBoard runs independently of the PC and has drivers for LCDs, DTMF and more. The unit is suitable for 24-hour operation. The price is $249 ppd. For more information contact *Highlands Electronics 13720 Lake Shore Drive, Clear Lake, CA, 95422; (707) 994-1024.* Or circle Reader Service No. 207.

Number 26 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

By now, you've all probably heard about a ham in San Diego who, utilizing an amateur HT modified to transmit on public service frequencies, used a Sheriff's Department frequency to get emergency medical help for an injured friend. The ham in question stated that he first tried to use several amateur repeaters, a commercial repeater operated by his employer and a cellular phone, all without success. Shortly after the incident, the ham was called into the sheriff's office, and his HT was confiscated. As of this writing no further action against the ham is planned, though he *could* receive a year in jail and a fine of up to $100,000.

Not too many years ago, this incident couldn't have happened. You don't have to be very old to remember a time when amateur radio transceivers didn't have the capability to receive, let alone transmit, on anything but frequencies allocated to the Amateur Radio Service. Along with miniaturization and microprocessors came the capability for wideband reception. I have no hard data on this, but I'd be willing to bet that the amount of time that passed between the first sale of an HT capable of being modified to transmit out-of-band and the first HT to receive that modification can be measured in hours. The same goes for HF transceivers. Hams are by nature tinkerers, and the fastest way to get them to open the case of their new Whiz Bang 1000 is to hint that a snip here and an extra diode there will give them added capabilities. Even if those capabilities happen to be illegal.

We have become so used to being able to modify our VHF gear, especially HTs, that we long ago stopped examining the legal and ethical ramifications. Heck, you don't even have to do the modification yoursell. For the last few years, every hamfest I've attended has had at least one vendor offering to do HT modifications for a price.

The incident in Southern California has presented us with the opportunity to make a little self-evaluation. Isn't possession of a radio capable of transmitting on police frequencies illegal? Certainly such transmitters are not FCC type certified for operation on public service frequencies, making them illegal in that regard. Why do hams feel the need to own such a radio — a radio they can't legally use?

I'd like to get a discussion going on this issue, so allow me to express my opinion. Taking the reality of the particular incident in question, I would have done the same thing *if* the injured person was in immediate danger (I don't know whether or not that was the situation in this particular case, but let's assume it was). To me, that is a seperate issue from whether or not hams should own police transmitters. When a fellow human being is danger, it is our moral obligation to assist with any means at our disposal. The question is really whether or not the ham who made the call should have had possession of the radio in the first place. I vote no.

The common ownership of illegal radios bothers me on several levels. In case you haven't noticed, hams aren't exactly looked up to by the general population. We are generally thought of as geeky techno-nerds, walking around with HTs on our belts to impress each other, talking incessantly about nothing of any importance. Sure, once in awhile a disaster strikes and the rest of the world remembers why amateur radio is such a good idea, but most of the time we are made fun of (whether or not this opinion of us is justified is a discussion we will have to save for another day). While you may think it's "cool" to show your neighbor that you can key up the local police repeater, I can assure you that your non-ham neighbor doesn't think it's "cool" at all. We have a responsibility to use the generous privileges we have been given with some amount of maturity. Breaking laws doesn't make us any friends.

"We have become so used to being able to modify our VHF gear, especially HTs, that we long ago stopped examining the legal and ethical ramifications."

I also have a problem with any unauthorized person having transmit capabilities on any public service frequency. Those of you who know me well may think this goes against my conservative views of the absolute authority of the First Amendment, and my "less government is better government" stand. Not so. In areas of national security or when talking about agencies charged with public safety, it is necessary to safeguard communications. The ham in San Diego certainly used his illegal HT for a noble purpose, but another person may not. If you think that hams are above such petty and harmful activity, I ask you to recall the high school radio club advisor who was arrested and convicted last year lor making false distress calls on police frequencies.

Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

Don't expect January to be a particularly good month for operating conditions on the HF bands. As you can see on the calendar, many days are only Fair or trending to or from Fair. Also, many days are Poor or trending to or from Poor. The worst days are expected to be from the 19th through the 23rd, when the ionosphere is likely to be very disturbed and some severe geophysical "conditions" can be anticipated. The earth's magnetic field may be active or at minor storm levels on some of these days, and you may want to look lor auroral contacts on the VHF bands, particularly around the 20th, 21st and 22nd ol the month.

As always, WWV at 18 minutes past any hour will be your source of the solar flux values and the "A" and "K" indexes. The higher the value of solar flux and the lower the values of the "A" and "K" indices, the better propagation will be. As this is written, solar flux has been in the mid-80s to mid-90s, while the "A" and "K" indices are very low as well. As a result, DX "conditions" have been very favorable on the bands between 15 and 40 meters.

When the "K" index is between 0 and 3, and the "A" index is below about 20, together with Solar Flux values above 90, you may expect excellent propagation on the HF bands.

Even on Poor days, it may be possible to find some HF activity on north-south paths across the equator in both directions from th U.S. to Australia and New Zealand, and to Central and South America. The most active areas of disturbance concentrate around the north and south poles where the magnetic field lines are most concentrated, and often extend to latitudes between the Arctic (and Antarctic) Circles and the equator . . . that is, where we all want to point our antennas for DX to Europe and the Far East. Signal paths *across* the force fields are very difficult, whereas signal paths *along* the force fields may be useful for DX.

In general, then, plan your operating on the days marked Good on the calendar, and anticipate openings toward the east in the morning and toward the west in the afternoon and evenings (local time). Short skip will also be useful on the good and fair days out to a thousand miles or so during the daytime, and out to 2,000 miles or more in the evening and early morning.

You will find atmospheric noise from storms quite low this month, except on stormy days, and the 80 and 160 meter bands should be excellent around the US and even to DX areas, particularly in the very early morning around sunrise and in the late evenings before midnight. See you next month. W1XU.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
ARGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U S S R		40						15	15	20		
WESTCOAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U S S R		40	40					15	15	20		

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U S S R								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A=Next higher frequency may also be used.

JANUARY 1994

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F
2 F	3 F-G	4 G-F	5 F	6 F-P	7 P	8 P-F
9 F-G	10 G-F	11 F	12 F	13 F	14 F	15 F-G
16 G	17 G-F	18 F-P	19 P-VP	20 VP	21 VP	22 VP
23 F	24 F-G	25 G	26 G	27 G	28 G-F	29 F-G
30 G	31 G					

73 Amateur Radio Today

FEBRUARY 1994
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International Edition

Meteor Scatter

Bounce Your Signal Off a Star!

Standardize Your Microphones

Build a Portable 2m Quad

Computerize Your CW

73 Reviews

Kenwood TH-28A HT

XPERTEK Digital Voice Mail

73 Amateur Radio Today

February 1994
Issue #401

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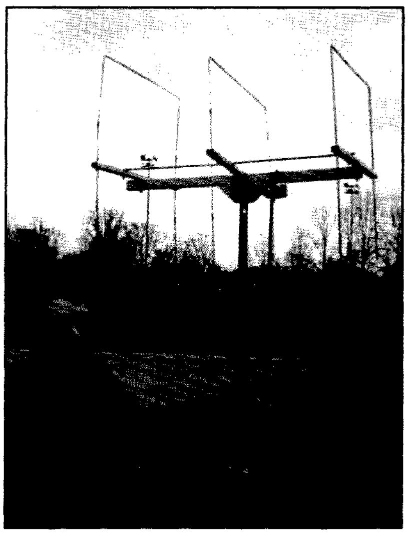

Build this portable 2 meter quad . . . see page 46.

REVIEWS

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Bounce your signal off a shooting star! Learn all about VHF meteor scatter propagation . . . see page 10. Star photo courtesy of the National Optical Astronomy Observatories. Antenna photo courtesy of Rutland Arrays.

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Uncle Wayne's Caribbean Adventures

The downside of the laptop computer is how easy it makes it lor people to write. People like me, lor instance. Naturally I had my little Mac PowerBook with me when I made my 11-island 21-day Caribbean ham-music-diving 71st birthday celebration safari in September. In between mini-hamfests, scuba diving, flying from island to island, and reading a pile of books I'd brought along, I somehow managed to write a blow-by-blow travelogue of the adventure.

Any seasoned reader of my editorials will not be surprised that it quickly assumed epic proportions. It started as a simple letter to my Aunt Kitty in Joliet, but it grew legs. By the time I got the whole thing together it ran a *Reader's Digest*-sized 40 pages. Then I added a story from my 1992 visit to Dominica, where I almost got skewered by a thrashing diving ladder. Say, why not include a hilarious story I did about my diving cruise on the Ocean Quest a couple years back? And a couple other Caribbean diving vacations?

I somehow couldn't help myself from sending a letter to the dive operators on the islands I'd visited, telling them how to improve their product. I added that to the saga. And being into economic development here in New Hampshire, I saw lots of opportunities for the Island leaders to attract more tourists and develop industries to pull their countries out of poverty. And most of them are deeply embedded in poverty. I added that to the saga too. I'll send the letters to the leaders, knowing they probably won't bother to read them.

Though these were mainly scuba diving trips, and thus you, as a mono-interest person, totally dedicated to lousing up what shreds we have left ol what was once a glorious hobby, probably could care less about the adventures of frugal septuagenarian Uncle Wayne. Worse, the writing, according to my critics, is vintage Green. Pity. Well, anyone who reads this pile will certainly know Uncle Wayne better. Maybe I should start billing myself as Grandpa Wayne. Gramps. Grumpy Gramps. Gimpy, grumpy Gramps, honoring my gimpy left knee.

When I get finished with the saga it'll probably run 80-100 pages. It'll cost something to print, so I can't just give it away free. How about $5? Postpaid? For $10 I could include pictures, but finding a ham with a spare $10 bill is so unlikely that I didn't even con-sider that. Maybe, instead of buying popcorn and a drink at the movies next time, you could spring for my *Adventures?* It's amusing stuff.

But then you haven't bothered to send lor my work of sheer (thin) genius, *We the People Declare War On Our Lousy Government*, wherein I present you with the keys to solving most of our more serious social, economic, political, and ecological problems. Oh, a few readers have read It and I appreciate their enthusiastic letters. I'll feel even better if I see some of them deciding to actually do something about cleaning up Congress, cutting crime, and improving our miserable school system. Politically I'm not ultra-right or ultra-left—maybe I'm ultra-center. No, I'm pragmatic, wherever that fits.

My enemies will love my *Adventures*. So will my friends—both of them. Everyone else will, as usual, sigh, turn the page and forget all about it. Of course, if I can get you hooked, I might be able to foist off the 20 issues of my *Declare War Update*. reports.These beauts run 16 pages each. One of these days I'll edit 'em, toning down some of my perhaps too clearly expressed frustration with the political baloney here in New Hampshire, and print the reports as another book. There's a ton of good ideas in 'em. Check Uncle Wayne's Bookshelf and see if we've managed to list this stuff there. Then send money. Or call our 800 number.

OK, You Electronic Experts

I've just heard from a second *73* reader who says, "I don't care what some loony researcher has shown, I know that all this stuff about 60 Hz magnetic fields hurting people is bunk." I asked both if they'd read anything about the research. They hadn't, because they knew it was baloney, so why waste their time?

This reaction Is one scientists should appreciate, because this same approach is endemic in the scientific community. It's dandy retribution when it happens to them. In the science business the deck is stacked against research in any new field. A scientist's success is measured by the number of papers published. The more papers, the easier it Is to get research grants. But the scientific journals are reluctant to publish papers which challenge orthodoxy, thus making sure that research projects are not challenging. The result is that today science has lost its spirit of adventure.

In the past scientists have held on to their beliefs tenaciously, and only reluctantly accepted new ideas when there was no other refuge. Let me quote Max Planck, the pioneer in quantum physics: "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that Is familiar with it."

Quantum physics really shook up the scientific world. It answered some questions, but in the process it opened up many more that scientists are still struggling with. It's fun to read about all this. I've read several fascinating books recently on this subject. I really should review them for you and see if I can get you to read them. There's *The Holographic Universe* by Michael Talbot, and *Parallel Universes* by Fred Wolf.

As usual, I digress. Well, there are so many interesting things to talk and write about that my talks and writing seem to mainly be a long series of digressions. Perhaps my recognizing this has contributed to my cutting way back on the number of talks I've been giving at hamfests and conventions. About the only hamfest where I've been speaking lately is at Dayton. I've been thinking of stopping that too. There are just too many exciting things to talk about and too little time.

Electromedicine

Now, undigressing, and getting back to bioelectromagnetics and bioelectricity, I read a book while on my birthday Caribbean tour that I just have to tell you about. It's *Cross Currents* by Robert Becker. The subtitle is: "The perils of electropolution and the promise of electromedicine—a startling look at the effects of electromagnetic radiation on your health." This book really kept my highlighter busy. It was exciting to read.

Not only will the research that has been done in this field fascinate you, it may well get you to thinking about setting up a little lab and investigating some areas where there's still a need for basic research—research which is within your ability to do.

The more you read about life and the cells which make up life, the better you understand that life can be seen as fields within fields within fields. And this is helping to bring about a revolution in medicine. We know now that chemicals and surgery aren't the only possible ways of curing illnesses. We know that the mind can influence the body, and that the body has a powerful innate self-healing system. So we're seeing a growing interest in "unscientific" approaches such as acupuncture, placebos, visualization, homeopathy, hypnosis, healing, foods, herbs, meditation, and electromedicine. Are there more productive approaches to tackling illnesses such as diabetes, AIDS, chronic-fatigue syndrome, Alzheimer's, autism, and even cancer? Is it possible that a physicist who is an ex-ham really has a little simple-to-make electrical gadget that can cure AIDS? I'll tell you more about that further on is this editorial. He also has an electronic gadget that stops drug addiction in its tracks.

Now, back to Becker's book. He starts out with the history of medicine, explaining how it has evolved. You're probably familiar with the story of how Lister discovered germs, how physicians refused to believe him, and continued to kill most of their surgery patients through infection for many more years. Becker didn't mention that, but it makes a good point.

Scientists have found that our bodies work on an incredibly complex combination of both chemical and electric actions. So Becker got interested in how salamanders are able to regenerate arms, legs, and tails. Maybe, if we understand how they do it, we might be able to regrow human arms and legs. He discovered that very minute electrical currents controlled the regrowth phenomenon. Minute being billionths of an ampere!

You'll read about how he applied his new understanding to the regrowth of leg parts in rats, and in helping speed bone fracture healing. You're not going to like this, but researchers have found an amazing correlation between the voltage points on the body and the acupuncture points of ancient Chinese medicine.

Becker traces the history of cancer research and the changing medical beliefs about it. The newest research indicates there is an electronic biological control system involved. This would help explain spontaneous remissions, the placebo effect, and so on.

Our Microcurrent Analog System

Our body works much like a computer, using digital communications for all our senses—sight, hearing, taste, smell, touch. But beneath that more re-

Continued on page 85

LETTERS

Number 2 on your Feedback card

From the Hamshack

Randy Crase KB7UIT, Woodland WA Wayne, I just finished writing out my check to renew my *73* subscription, and also reading your editorial in the September '93 issue. Great job, Wayne. Actually, I have read many of your editorials in the two years I've been licensed. One theme stays constant: I fully support your views on the ARRL and do not belong to the organization or subscribe to *QST*. In your last editorial you again brought up the fiasco of CW. You also stated that the ham population should circumvent the ARRL in proposed new rule changes to the FCC. How does one go about proposing rule changes?

I am a No-Code Tech and, like many, do not care to spend the time learning code at 13 wpm to get a General Class license. Supposedly, by ITU convention all HF privileges are to be allowed upon passing a test for CW. However, there is no requirement about speed. What I would like to see is a 5 wpm requirement for all license classes, or elimination of CW as a requirement. I know that the "live and die by CW" group will throw fits and keys at this proposal; that's OK. The majority of hams now are No-Code Techs, and the number is increasing. Most of these people are not "glorified appliance operators." I have talked to many very intelligent No-Code Techs—doctors, engineers, programmers, etc. These people could pass just about any theory test you could toss them, yet they are still No-Code Techs. They do not upgrade because they don't want to "waste the time" on an "ancient form of communication." I have absolutely no problem with requiring a theory test for various classes of licenses.

If No-Code Techs are "glorified CBers" then more power to us. All I need do is turn on my VHF equipment and listen to very little garbage, or turn on HF to 14.313 or 40 meters and listen to some of our "superiors" trash the band.

Wayne, keep on pushing the ARRL. It's now time to get rid of the code requirement, or at least make it so easy that it's just a nuisance.

Well, gee, I dunno . . . Wayne

George M. Badger III, San Jose CA Wayne, you certainly are an EE (Eclectic Editorialist) if I ever saw one. And at my age I have seen more than four. Your October '93 editorial brought up a very good point: The majority of nam QSOs are *very* boring and very often pedantic. It seems that quite a few of the hams on the air are old, unhappy and definitely right-of-center. Getting older has its rewards, one of which is that we all have a larger cross section of experiences to draw upon and therefore we should have more to talk about. Nope, it doesn't seem to work that way. I don't know why people are not excited about their lives and want to learn more about others' lives and therefore enrich their own. From my small outpost in the world, the loudest complainers are generally a small minority who are "control freaks" afraid of CHANGE! They go out and spend for *large signals* so they can attempt to prevent others from having their own experiences. They are often accompanied by labels so they will be able to identify their own "tribe." Or is it diatribe?

Wayne, you are correct. Life is not a spectator sport. If you are not part of the solution, you are definitely part of the problem. Anybody can sit back and point out how something may not work, but it takes a real person to stand up, join in and make things happen. Hey, tell them this: "If you don't like the news, go out and make your own."

Thank you for the features on QRP. I am in the process of co-writing a book on ORP and equipment modifications that should be out mid-1994. I'm an ex-ham who has missed hamming and am in the process of retrieving my ticket. Solar QRP DX is my bag.

Good grief, another troublemaker . . . Wayne

Ed Eggert W3HIK, Fair Haven NJ Just a quick note to let you know how pleased I am with the Packet Mac modem out of your October 1992 issue. Dexter Francis of Sigma Associates is a delight to do business with. He was kind enough to answer all my questions about the modem before I ordered one.

I had purchased a commercial TNC to use with my Mac and after three months of faxing back and forth I still could not get it work. Try as they could, they admitted that they did not have a Mac to test it with.

The Packet Mac, along with Savant software, worked without a hitch. If you have a Mac, it's the only way to go. Now, if we can convince Dexter to design a regular modem with fax for the Mac we will have it made.

Thanks for running the article.

Harry M. Johnson NV7K, Kalispell MT I just finished reading the December 1993 "Never Say Die" and I feel I must write to you. I've recently purchased some new items that I feel motivated to report on as per your request. I generally use boat-anchor-type equipment that I acquire and then restore to working condition, but occasionally I feel the time is right to purchase some type of new gear.

I would like to review a new book I have purchased (new to me, that is): *Solid State Design for the Radio Amateur* by Hayward W7ZOI and DeMaw W1FB. It is published by the ARRL and the price is $12. I have an academic background in the biological sciences and education and have a solid foundation in physics and math, but I need references when I want to build certain types of circuits. While building an oscillator, filter, etc., it is very nice to be able to look up a circuit and quickly determine component values without having to do it by trial and error. I have sought out this type of reference work on many occasions and have really never found one to do the job, until this one. Some representative chapter headings are: "Semiconductors and the Amateur," Basics of Transmitter Design," "Power Amplifiers and Matching Networks," "Receiver Design Basics," and "Test Equipment and Accessories."

I live in a rather isolated area with respect to retail amateur radio dealers. I can order by phone or fax or USPS, but sometimes you just can't beat hands-on shopping. A few weeks ago, while visiting my uncle, W7GBI, and his family, we had occasion to visit one of the Ham Radio Outlet retail stores. While browsing over the book shelves, I spotted Hayward and DeMaw's book and knew then and there that it was what I was looking for. I know it is not a new title, but I had not seen it before and it really meets a need for me.

Another new item I would like to share is an ICOM IC-2iA 2 meter handie-talkie. We were looking for a very small, uncomplicated HT. While at the same HRO store, we looked at and got the feel of all the mini HTs. The IC-2iA is definitely the smallest and has the fewest external controls. The neat part is that by using the few controls on the outside in various combinations and permutations one can program onto the CPU all of the operating parameters used by your average 2 meter repeater user. Clock setting, power on and off times, CTCSS tones, DTMF autodialing, paging, and power levels can be preprogrammed in and then actuated with a few well-chosen keystrokes (two or three in all cases). The radio has two levels of programming: the basic for everyday functions used most often, and an advanced mode with the more complex levels of operation available. There is even an AI mode in which the HT learns which functions you use most often and expands the programming to suit what it perceives as your needs.

Wayne, no doubt about it, you are a windbag, but I guess I, and your other faithful readers, wouldn't have it any other way. I do find *73* to be the most interesting of the "Big 3" not only because of your editorials but also because of the general content and the types of articles and regular columns that you include. Thanks for a good job and I won't worry about you becoming complacent and resting on your laurels because of too much praise.

Me a windbag? Harrumph . . . Wayne

Tom Tobiassen NØBZ, Aurora CO Wayne, in response to your December 1993 editorial, I would like to give you my rating of a ham product.

I would rate my Kenwood TS-50S HF transceiver as a "9." I purchased this radio last spring and I've been very happy with it. I have always been interested in operating HF from the car while traveling and I've dreamed of operating HF while on vacation. This radio has given me the opportunity to do both this past summer. While on vacation at Grand Teton National Park, Wyoming, in July, I operated 20, 15 and 10 meter SSB while in the car chatting with folks all over the U.S. I operated 40 and 15 meter CW from the rented cabin using a dipole, chatting with other hams all around the world. I really enjoy this radio.

Ed Malkranz KG5UN, Abilene TX Wayne, greetings from West Texas. I work as a firefighter-EMT here. I have been a ham since 1988. I also spent eight years in the army as an HF RTTY operator.

I want to tell you about the two latest additions to my shack. The first was an ICOM IC-729 HF and 6 meter rig. This is a nice, compact, easy-to-use radio; not too complicated. It has simple controls and comes with good instructions. I have been using it for a little over a year and am very pleased. It works great in all modes. Shortwave listening in AM sounds very nice. The noise blanker and preamp are both very effective. It handles RTTY, AMTOR, PACTOR and packet with no problem. The radio works like a champ on 6 meters also. It's a good receiver for weak signals, and does a fine job with FM simplex and repeaters as well. All it needs is transverter connections on it.

A few weeks ago I picked up an MFJ 1278B multimode data controller. This is a very versatile unit. On packet it works great, and has a nice built-in mailbox. RTTY, CW and AMTOR are easy to use and do very well. PACTOR is a nice mode and this unit supports it very well. I have copied color slow-scan pictures with good results and also copied a lot of fax pictures with very good results. This was a good value for my money.

My radio interests are quite varied. I like chewing the rag on HF, mainly on 17 meters. I enjoy all of the HF digital modes as well. I also enjoy weak-signal VHF work, currently on 2 and 6 meters. I have done a lot of meteor scatter work as well, and have made contacts on the RS satellites.I hope to get on the OSCAR birds soon, as well as doing UHF weak signal work.

QRX . . .

Number 3 on your Feedback card

Radio Operators Behind Bars

Three young residents of the California Youth Authority's Camp Fenner recently received their amateur radio licenses after a long period of study. The idea was formulated by Parole Agent Bill Goff KI6DJ, with assistance from Teacher Ed Griffith KC6WCT. All three wards were first carefully screened for the proper levels of ability, motivation, and rehabilitation.

Organizers say ham radio teaches discipline, cooperation, and geography—not to mention electronics. For some youthful offenders, this is their first experience being cooperative or successful. The program is believed to be the first of its kind. Anyone with experience using amateur radio to rehabilitate young men should contact Ed Griffith KC6WCT, P.O. Box 30275, Stockton, CA 95213-0275; (209) 825-9458. *TNX KC6WCT.*

Wanted: Young Hams

Once again, Carole Perry WB2MGP is looking for articulate, active amateur radio youngsters up to age 18 to be interviewed for possible participation in the Dayton 1994 Youth Forum. This year's forum will be bigger and better than ever. Please contact Carole at P.O. Box 131646, Staten Island, NY 10313-0006, or telephone her at (718) 983-1416. *TNX WB2MGP.*

Huge Cable

A private venture with financial backing in the United States, Japan, and the Middle East, is planning to construct the world's longest under-sea fiber-optic cable, linking Europe, the Middle East, and Asia through 13 landing points. The new cable will join existing undersea links to open up broad bandwidth international multimedia services by 1996.

The Fiberoptic Link Around the Globe (FLAG) will cover 18,000 miles, from Britain through the Mediterranean Sea and Indian Ocean to Japan. FLAG is expected to complete the first global high-capacity fiber-optic highway of great capacity. The link would support 600,000 conversations simultaneously and support teleconferencing and entertainment video too. The huge cable would likely compete with satellites for business. *TNX Electronic Engineering Times, December 6, 1993.*

Semiconductors: A Girl's Best Friend?

With financial backing from the White House, Russian and American scientists are beginning collaborations to develop new semiconductor technologies based on diamond films. The Clinton Administration has allocated funding to support the work of 20 Russian scientists for a year.

Russian diamond technology first came to light in 1977. Reports were largely ignored in the U.S. but were pursued in Japan. Now the University of Missouri has established the International Diamond Research Institute where researchers will work with the Laboratory of Diamond Fiim Crystallization at the Institute of Physical Chemistry in Moscow.

A primary goal of the new institute is to develop reproducible n-type and p-type diamond films that are more rugged than silicon for a new generation of semiconductor devices. *TNX Electronic Engineering Times, December 6, 1993.*

Boyer Wants His HT Back

According to newspaper accounts, Chris Boyer KC6UQG, who accessed a sheriff's department radio frequency to summon medical help for an injured friend, now wants his portable radio back. Reportedly, Boyer first tried to get help via amateur radio, business band, and cellular phone, but to no avail.

Boyer contends that he made a responsible decision to use the Sheriff's frequency only after exhausting all other communications options. His friend had been hurt in a mountain bike accident and was bleeding. Two weeks after the incident, Boyer was called into a meeting with FCC and sheriff's department officials, where he surrendered his radio. It is not clear whether the radio was actually confiscated, or if it was volunteered in lieu of prosecution. *TNX Westlink Report, No. 662, November 26, 1993; W5YI Report, Issue #23, December 1, 1993; The San Diego Union Tribune.*

Form 610 is New

A totally new FCC Form 610 is on its way into ham radio as a result of a new computer at the Federal Communications Commission. The venerable old 610 will soon fade into history as a result.

The new form is streamlined. It does away with all of the boxes previously contained in the administering VE's report. The report itself has been relocated to the bottom front of the form, right above the VE certification area. The administering VE will now only need to indicate which one of six classes the applicant is qualified for. The sixth category is "Technician Plus" and its inclusion on the new form indicates the commission wants to carefully track the popularity of this category.

Sections to report current station location and change of station have been eliminated. The new 610 still has a Physician's Certificate of Disability for those exempt from the code tests due to physical disability. This new form replaces the March 1992 version which carries a February 1995 expiration date, but which can no longer be used once the new form is in the hands of the public. *TNX Westlink Report, No. 662, November 26, 1993; Newsline; W5YI-VEC.*

Hams Cool Under Fire

Hams did more than just talk at the scene of the recent wildfires in Southern California. They put their lives on the line staffing the DCS22 Mobile Communications Van at Pepperdine University at the height of the fire threat. Hams also handled the fire hoses as flames assaulted the Malibu Sheriff's Station.

After 108 hours of continuous operation, Scott KD6NEA closed down the emergency operation by saying: "The cooperation of all amateurs in clearing the frequency for this net has been greatly appreciated. The frequency is now clear at 1800 hours." FB to all who pitched in. *TNX Westlink Report No. 662, November 26, 1993.*

Cuba Incommunicado

Third-party message privileges with Cuba—previously authorized—are no longer approved. According to Rafael Estevez WA4ZZG of Hialea, Florida, when Hurricane Andrew demolished much of the public communications capability between Cuba and Florida, the Cubans resorted heavily to amateur radio.

The pro-Castro Cuban American Radio Federation has taken a renewed position that Cuban amateurs should not communicate with the "enemy," meaning Florida amateurs of Cuban descent. Rafael says that Cuban amateurs are getting their licenses suspended from three months to a year for passing such innocent non-political health-and-welfare traffic as ". . . appealing for aspirin and insulin."

CO2QQ advised Rafael on the air recently that the United States and Cuba no longer have a third-party agreement. Information is now moving in and out of Cuba with great difficulty since AT&T's over-the-horizon communication system was damaged by Andrew. *TNX W5YI Report, Issue 23, December 1, 1993.*

Power Stream

Three men claim they have invented a battery which is powered by a plentiful natural substance available at low cost—urine. Many scientists are highly skeptical of the inventors' claims, especially without an explanation of the battery's purported chemical reactions and construction.

The urine battery's inventors, Nelson E. Camus, Edgar Aguayo, and Ismael Valle, are partners in an electronics company called Nel Nithium Electronics. They say their information is a secret they are not about to share.

The men are looking for investors with $5 million. They claim their home power plants will be cheaper and smaller than existing power sources, are environmentally sound, and will boost the economy. They estimate the cost to perpetually power an average home to be around $500. *TNX Associated Press; San Maeto Times; and Palo Alto Amateur Radio Association PAARA Graphs, December 1993.*

VHF Meteor Scatter Propagation

Bounce your signal beyond the horizon.

by Steve Katz WB2WIK/6

I'm writing this after returning home only hours ago from a little expedition to a local mountaintop to work the 1993 Perseids meteor shower, which was supposed to have "peaked" at 0100Z on August 12. Wayne Overbeck N6NB (well-known for his VHF-UHF exploits, as well as for designing the popular "Quagi" antenna) and I headed up to his new mountaintop VHF contesting site at 6,800 feet above sea level in the Tehachapi Mountains, about 90 miles northwest of Los Angeles, to "work" the shower on 50, 144, and 222 MHz. We had some success, but not as much as we had hoped for.

The 1993 Perseids shower was hyped as the biggest news for astronomers, meteorologists and VHFers alike since the return of Halley's comet. Like all meteor showers, this one occurs when bits of debris left by passing comets come close enough to our planet to be pulled in by the earth's gravitational field. Cyclic in nature, meteor showers recur every year at about the same time and there are many showers each year. But *this* one was supposed to be the "big one," with hundreds of meteors falling each hour. It should have had a major impact on VHF propagation and been a wonderful sight to behold, with "shooting stars" filling the sky.

Well, as of today, the shower wasn't what it was hyped to be, and the number of meteors we worked and saw were not all that unusual. But maybe we missed the peak, and the 1993 Perseids may turn out to be all the wonderful things the astronomers said. Either way, it's still fresh in my mind that a lot of hams, newcomers and old-timers alike, don't seem to know much about meteor scatter, and that's the subject of this article.

Working Meteor Scatter

Meteor scatter propagation occurs when signals are reflected off the ionized trails which follow meteors as they enter our atmosphere. In deep space, bodies traveling very fast don't generate any heat to speak of, since they encounter no friction in their travel. But meteors and other bodies entering our atmosphere generate considerable heat as the density of our atmosphere creates friction to their travel. Since our atmosphere contains gasses prone to ionization and even ignition, the meteors literally "burn up" on entry, and most are extinguished before they reach the surface of our planet. Occasionally, a larger meteor makes it all the way down to earth and plunges into the ground, ocean, or some other obstacle. When a meteor successfully reaches the planet, it becomes known as a meteorite.

The ionization of gasses behind the meteor as it plunges towards earth is highly reflective to radio frequency signals and allows brief reception of distant signals not normally workable on the VHF bands. Random meteors, not members of a known "shower," are workable frequently on 50 MHz year-round, if well-equipped and trained operators are at both ends of the circuit. The meteor scatter signals reflected by a random meteor path may only be present for a few seconds, and another meteor may not come along for a long while. Thus, to complete a contact (or QSO) via a random meteor requires considerable skill on the parts of both operators involved, since all information must be exchanged in a very short period of time. Signals are typically weak and "peaky," and to successfully work random meteors, high power levels and high gain antennas are usually employed. At higher frequencies like 144 or 222 MHz, even greater skill and better equipment is required because the signals tend to be even weaker (due to path loss, which is related to the number of wavelengths the signals must travel). At 432 MHz, meteor scatter work is rare indeed, although it has been performed.

Think of the ionized trail left by a meteor as a reflector in the sky. Its shape is long and skinny, and it is literally a moving target. It would be impossible to "track" a meteor's path through the heavens, as these bodies are traveling much too fast to steer antennas at them as they travel. And their flight pattern is quite unpredictable. So, to work meteor scatter, most folks find it best to just aim antennas directly towards the station they are trying to contact, keep them fixed on the

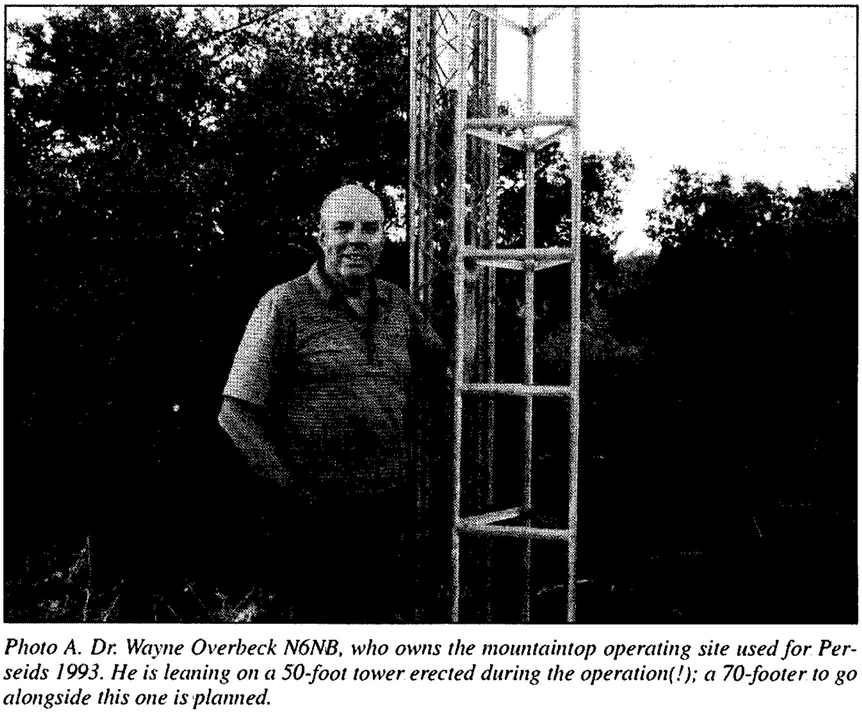


Photo A. Dr. Wayne Overbeck N6NB, who owns the mountaintop operating site used for Perseids 1993. He is leaning on a 50-foot tower erected during the operation(!); a 70-footer to go alongside this one is planned.

Photo B. "Antenna's-eye" view from the meteor-scatter operating perch in the mountains at 6,800 feet. The valley floor below the antennas is 3,000 feet lower, and the nearest obstacle of significant elevation is more than 200 miles away.

horizon in that direction, and hope for the best. In this case, hoping for the best is essentially wishing for a meteor to fall between your location and the location of the station you are trying to contact, and for that meteor to be low enough on the horizon that its ionized trail will be a useful reflector. It's actually quite a lot to hope for!

But during a major meteor "shower," when meteors fall at a reasonably fast rate (60 per hour is not unusual), the probability of making contacts by using their reflective "tails" is dramatically increased, to the point where modestly-equipped stations with a small degree of training and skill might successfully complete a few contacts. What is *really* required?

First, realize that meteor scatter (m.s.) signals are weak and "peaky" in nature. By "peaky" I mean they change in strength from literally zero to some workable level and then back to zero again in a very short time, ranging from less than a second to maybe a few seconds. A "zinger" (huge meteor with a long "burn" time) might allow a "burst" that lasts several seconds, but when it's gone, signals will typically fall back to zero again. For these reasons, only "weak signal" modes like SSB and CW have been used effectively for m.s. propagation. Wideband modes like FM are not successfully used, although if tried with a tremendous amount of power and antenna gain, I suppose it might be possible. But remember, signals are typically weak, and CW has a 20 dB signal-to-noise ratio advantage over FM-and that's a whale of a lot. If FM could be used to make the grade at 1,500 watts output power, then just 15 watts would do it on CW. Normally, 15 watt stations are not successful in m.s. work.

So, if you want to expand your horizons on VHF, stick with SSB or CW. (CW was once used almost exclusively for very long DX work on VHF-UHF, including meteor scatter, aurora, moonbounce, etc. But with higher antenna gains, receiver improvements and so forth, SSB is now quite effective and is often faster for making contacts.)

Second, understand that to have any real success in "over-the-horizon" type VHF-UHF work, be it m.s. or normal tropospheric propagation, it pays to have a zero degree or below zero degree horizon in the direction you want to make contacts. If you put your eye at your antenna level and appear to be looking upwards, above level, at the surrounding terrain, you will not be terribly successful at making contacts in those directions where you have this "positive horizon." If you have a "negative horizon" in *any* direction that might be useful in making contacts, use *that* direction for your m.s. work. If your location is such that you have a "positive horizon" all the way around you, it would be wise to pack up the station and go hilltopping (portable from a mountaintop) instead. You'll be much more successful than working from home.

Third, because m.s. path losses are very high and signals are weak, it pays to run as much power as possible. Meteor scatter has been successfully worked with lower power (like 100 watts) but a kilowatt or more sure helps. Keep feedline losses to a minimum and use antennas that have some real gain. But too much antenna gain can sometimes be a hindrance, because a *lot* of gain means a very narrowly-focused antenna system with a sharp front "lobe," and using such a system can make you miss the meteor trails you want to work. Probably 13-15 dB antenna gain is the suggested range for most m.s. work, as it is sufficient to make contacts but not so much that an extremely sharp pattern will result.

Fourth, and maybe most important, is operating procedure. Meteor scatter operators must be *quick*! A good "burn" might propagate signals for several seconds. If you operate well and have lightning-fast reflexes, you can complete an entire contact in that time. For a QSO to count, it is usually deemed that exchange of two pieces of information is required. Many years ago, those two pieces of information were a callsign and signal report. Since meteor scatter signals come and go rapidly and it is common to copy only portions of a transmission, an m.s. signal reporting system was established, using the letter "S" followed by a number which indicated how much of the other station's transmission you heard. For example, "S2" meant "I've heard your complete callsign. Now send me something else." It did *not* mean the other station was indicating "S2" on your receiver's S-meter!

Nowadays, with modern equipment, big amplifiers, high-gain antennas, low-loss feedlines, mast-mounted receiver preamplifiers, digital signal processors, etc., I think the old "S" reporting system will be going away. Instead, it would be prudent for stations to exchange callsigns and a grid locator. Grid locators are alphanumeric codes used to indicate any station's location with some precision and are internationally rec-

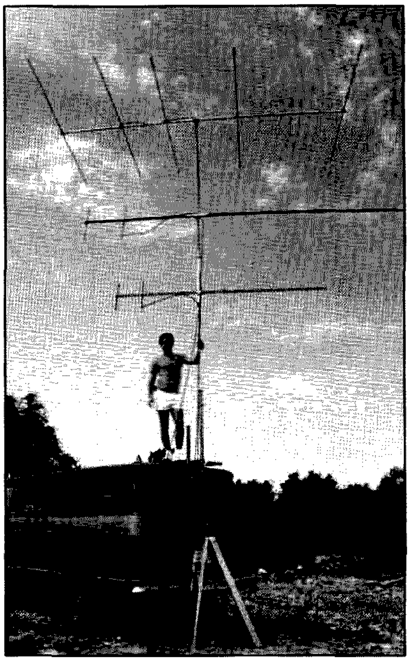


Photo C. The author atop N6NB's van, to the rear of which is permanently mounted a 30-foot telescoping, rotating mast with a HAM-M rotor at the bottom. Portable antennas were simple: five elements on 50 MHz, and eight elements on 144 and 222 MHz. To minimize ground influences, the lowest-frequency antenna goes at the top, highest up.

Photo D. The author, at the controls of N6NB's contesting van, which contains KW stations for 3.5 through 432 MHz, and a gasoline generator to run it all. Almost like home!

ognized as a standard for VHF-UHF station location information. A four-digit code will indicate your location to within one degree of latitude and two degrees of longitude. Because the earth is an oddly-shaped spheroid (sort of a round ball with a bulging middle), these grids will change in area from point to point on the globe. Grids are not all the same size. They are smallest at the poles, and largest at the equator. But the system is better than nothing, and at least it's a standard. And the ARRL offers VUCC (VHF-UHF Century Club) awards for confirming contacts with numbers of grids (contact the League for more information) and the grid locator number is the standard exchange for most VHF-UHF contests now. Because the grids are fairly large, knowing another station's grid won't help you much if he is close by, but the information is valuable when making distant contacts, say a few hundred miles or more away, for beam-heading directions.

So, I propose (and I see many operators are already doing this) that instead of exchanging meaningless "S" reports, we just exchange callsigns and grid numbers to complete meteor scatter contacts. I *like* change, and I've been working meteor scatter since about 1966; if I can adapt, so can anybody.

Making the Contact

How does one make a meteor scatter contact? There are two ways: "Random," or unscheduled QSOs, and "skeds," or scheduled QSOs. To make a random m.s. contact, somebody has to call CQ! A typical CQ for m.s. work would be something like this:

CQ WB2WIK CQ WB2WIK CQ WB2WIK CQ WB2WIK CQ WB2WIK

CQ WB2WIK CQ WB2WIK CQ WB2WIK CQ WB2WIK BREAK

Note that this is quite different from an ordinary CQ. I've only used two "words": "CQ" and my callsign. All other information is extraneous and unnecessary. No reason to use words like, "This is . . . " or "in Los Angeles, California," or whatever. All that extra information takes up valuable time and the point in meteor scatter work is to get just the information that is absolutely required across to the other party. If someone heard my CQ, he would likely hear just a little portion of it. Hopefully, he might hear both "CQ" and "WB2WIK," and that's all he needs to know. If he were to answer me, he'd transmit something like this:

WB2WIK W7HAH WB2WIK W7HAH WB2WIK W7HAH WB2WIK W7HAH WB2WIK W7HAH WB2WIK W7HAH WB2WIK W7HAH BREAK

This is all he needed to say. It told me he was calling me, and it told me who he was. Nothing more is required. If I caught a meteor during his transmission, I probably would have heard some portion of this transmission. If I did, then I'd transmit:

W7HAH DMO4 W7HAH DMO4 W7HAH DMO4 W7HAH DMO4 W7HAH

DMO4 W7HAH DMO4 W7HAH DMO4 W7HAH DMO4 BREAK

This would tell Shep (W7HAH, who is indeed a VHF "meteor jockey") that I heard him, and I'm giving him my grid square. You can't assume *anyone* is where you think they should be, and the grid square data is pretty important. For example, in my case, I have a 2-land callsign and lived in grid FN20 in New Jersey for 30-plus years. But I'm not there now! Also, although my license reads "Chatsworth, CA," which anyone can look up to see is in grid DM04, I might have been operating portable somewhere else. The grid is important.

If Shep heard me, he'd probably respond:

WB2WIK DN26 WB2WIK DN26 WB2WIK DN26 . . . etc.

or he might just respond with:

QSL DN26 QSL DN26 QSL DN26 QSL DN26 QSL DN26 QSL DN26 QSL DN26 . . . etc., which would indicate he received my report and is now sending me his.

My last transmission to him, assuming I heard the above, would be:

QSL 73 QSL 73 QSL 73 QSL 73 . . . etc., which would indicate I received his report and am saying good-bye.

You see, simply sending a report on meteor scatter is absolutely no assurance that the other station heard it; thus, the "QSL" or "Confirm" or something *should* also be exchanged to indicate that the stations really heard each other and got everything they needed to make a complete QSO.

In real life, especially in the absence of a major meteor shower, it is common for a complete QSO to take a very long time, because each transmission as outlined might need to be made several times. Typical duration of an m.s. transmission is 15 seconds. Talk *fast*, and you can say quite a lot in that 15 seconds.

Now, what about if you catch a real "zinger" with a long "burn" and you hear the other station's entire exchange in one burst? Do you go into your 15-second routine? Not at all! If I had heard several successive seconds of W7HAH's exchange and he stopped transmitting, I'd immediately reply with:

QSL ALL 73 73 WB2WIK WB2WIK QRZ? BREAK

or something like that. I could say all this in less than five seconds and maybe get it all across in one shot, and possibly even stir up another meteor contact in the process. The point is, "make hay while the sun shines," to use a worn-out phrase; that is, take advantage of the meteor for as long as possible and do *not* waste time with a lot of repeating what the other station has probably already copied.

Often, especially for "skeds," or scheduled contacts, transmissions are *sequenced* with station clocks set precisely to WWV. Each station takes a 15-second "turn" at transmitting, and who transmits first is prearranged. For example, say it is agreed that the station who is farther west will transmit the first and third 15 seconds of each minute, while the station farther east will transmit the second and fourth 15 seconds of each minute. Of course, both stations must have their clocks set to the second by WWV, and this should be checked just prior to the "sked" time to make sure the clocks are accurately set. The advantage of sequencing is to avoid stations transmitting at the same time, which makes it impossible for them to hear each other.

How Far, and What Direction?

How far can you expect to work with meteor scatter? *Much* farther than with normal tropospheric propagation! Contacts to 1,500 miles or so are possible, although most will be closer, in the range of 500 to 1,000 miles. Still, this is quite an improvement over what can normally be worked on VHF. Sporadic-E skip, quite common on 50 MHz, often makes only "pockets" workable, and those "pockets" tend to be pretty far away. Very short "E-skip" usually lands at 500 miles or

more, and longer skip arrives from points out to 1,200-1,300 miles. ("Double-hop" E-skip occurs on 50 MHz, allowing double these distances to be covered; combinations of propagation also occur on 6 meters, which allows contacts of almost any distance, but these are rare.) If you are trying to work as many grids or states as possible, relying on E-skip alone can be frustrating. For one thing, E-skip is most prevalent in the June-July timeframe (in the northern hemisphere) and much of the calendar is devoid of E-skip activity. For another, E-skip at frequencies higher than 50 MHz is rare. Tropospheric "ducting" can allow extended-range contacts at 144, 222, 432 MHz and higher, but when the ducts occur, they are often quite narrow with regard to height and width and allow contacts only along a limited path.

Meteor scatter can allow contacts in any direction, at a variety of distances, and is a flexible mode of propagation that is highly useful for filling in those vacant spots on your "Worked All Whatever" map.

You will never forget your first meteor scatter contact. I've made hundreds over almost 30 years, and I still remember mine: It was with K8MMM in Ohio, when I lived in New Jersey. I was running 100 watts PEP output to a little five-element beam on 6 meters, and working Ohio seemed an impossible feat at the time. The distance (500 miles) was too far for normal "tropo," and too close for E-skip. The only way to do it was via meteor scatter. When I made this first m.s. contact, I felt like I invented this new mode. In fact, it had existed for many years and m.s. work was quite common even prior to 1960. I just didn't know. But I know *now*, and now *you* know, too.

Try it—you'll like it. But *please* follow the guidelines for operating listed here. If you don't, your success will be limited and it is easy to become discouraged. If you know a local, highly successful "meteor jockey" (operator who works a lot of meteor scatter), ask him for advice. He should be able to guide you through your first few m.s. contacts.

Oh, by the way: In our Perseids 1993 meteor scatter expedition discussed in the opening paragraph and shown in the photographs, we had at least some success. I made 32 scatter contacts on 50 MHz, and four on 144 MHz, in about four hours of operating time. Not too shabby, but not as good as we expected. I think we missed the peak propagation, which likely occurred after we shut down and left the operating site. The best DX on 144 MHz was DM79 in Colorado, about 1,000 miles or so away. We completed QSOs with Indiana and elsewhere east of the Mississippi via meteor-enhanced E-skip (on 50 MHz) and worked DO20 in Alberta, Canada, on 6 meter m.s. without skip. All this, using only small beam antennas (14-foot-long booms) at about 30 feet above ground. But we did run 1,000 watts output on each band, and our location was 3,000 feet above the Mohave Desert floor, which extended in front of us for about 100 miles, so this was a great location!

Good luck and let me know how *you* make out.

Number 5 on your Feedback card

Using the World's Most Accurate Frequency Standard, Part 2

Building a digital phase comparator

by Bob Roehrig K9EUI

[Editor's Note: This month's installment of this three-part series includes the PC board layout and parts placement diagram for the circuits described in Part 1, published last month. See Figure 5, page 22-23.]

Part 1 of this three-part series described the construction of a receiver for WWVB to be used for calibrating your local frequency standard. If you don't have a good local standard, it's easy to build one that can provide 0.001 part per million accuracy. Such an oscillator will be described in the final article in this series.

A standard with 0.001 ppm accuracy has a drift of less than one cycle in 20 minutes. Even an oscillator with 0.01 ppm accuracy, which I consider to be minimum for a decent standard, must be observed for at least two minutes to determine its drift rate. Clearly, this cannot be done by listening for an audible beat note by ear. The only way to check such a standard is visually.

The simple method of comparison involves using a scope to compare the received signal against the local standard. This method was discussed in Part 1.

A far better method of comparison uses a digital phase comparator. Just what is a phase comparator? Well, the usual forms of detection involve either rectification (to get audio from an IF stage in an AM or FM receiver) or a mixer (in the case of a product detector for SSB or CW). The normal forms of detectors are fine for signals in the audio range, down as low as we can hear, but what about signals that are less than 1 Hz?

The phase detector is used to compare two signals that are almost exactly on the same frequency. In a way, it is a form of mixer and it works down to fractions of a Hertz (DC actually).

The digital comparator has many advantages over the scope method. It is a much smaller unit than a scope, requires much less power, and is quite easy to build. It also has the capability of feeding a chart recorder or a computer via an A-D converter. The disadvantage in using the comparator is that your input signals must be much cleaner than for a scope.

The basic circuit is nothing more than an edge-triggered set-reset flip-flop. A simple version is shown in Figure 2. Each time a positive-going wave edge is applied to either input A or B, that stage turns on, which turns the opposite stage off. The two signals (A and B) shown in Figure 1 represent two signals that are on the same frequency but A is 90 degrees ahead of B. If these two signals are applied to the circuit shown in Figure 2, the output at point C will be that shown in the bottom line of Figure 1. The output at E will be the DC average of the duty cycle of the signal at C. Since A leads B by 90 degrees, the resulting DC voltage at E will be about 1.25 volts.

If the B waveform shifts to the right so it lags A by 270 degrees, then the voltage at C will be high 75 percent of the time so the average at E will be 3.75 volts. So you can see that as B drifts, compared to A, the average DC output at E will vary between 0 and 5 volts, which represents a 0 to 360 degree phase difference between the two waveforms.

If the DC voltage at E is used to control the frequency of the signal A oscillator, that oscillator will lock to oscillator B. This is a simple form of a phase-locked loop.

Figure 3 shows the real phase detector system. Actually, there are two comparators in this unit. First, a 6 MHz crystal oscillator is divided down to 60 kHz with a pair of decade counters, IC4 and 5. This signal is fed into comparator IC6. The 60 kHz from the receiver is also fed into this comparator. The DC output from the comparator is fed back to D1, which is a variable capacitance diode that adjusts the frequency of the 6 MHz oscillator. In this way, the 6 MHz oscillator is phase-locked to the received signal and has the same accuracy as the WWVB signal.

IC2 and 3 divide the 6 MHz by 6 to get 1 MHz and again by 10 to get 100 kHz. Either one of these is fed into the second phase comparator, IC7. The local oscillator to be checked is also fed into this comparator. In this way we can compare our local 100 kHz or 1 MHz oscillator against WWVB.

The only adjustment to be made is the coarse frequency adjustment, C1 on the 6 MHz oscillator. Connect the 60 kHz output of the WWVB receiver to J2 via coaxial cable. Observe the TP1 signal with a scope. Adjust C1 until an approximate 50 percent duty cycle waveform is observed. Disconnect the receiver signal momentarily, then reconnect it. The 6 MHz oscillator should

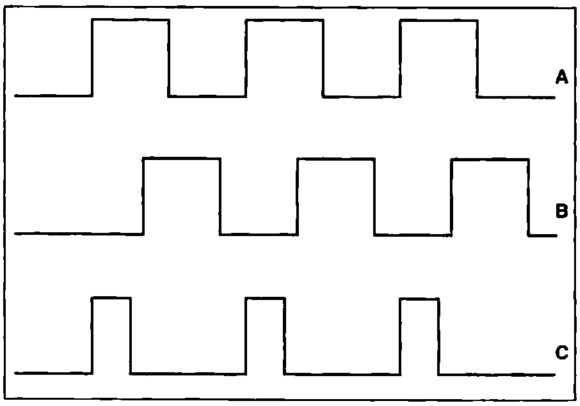


Figure 1. Comparator waveforms.

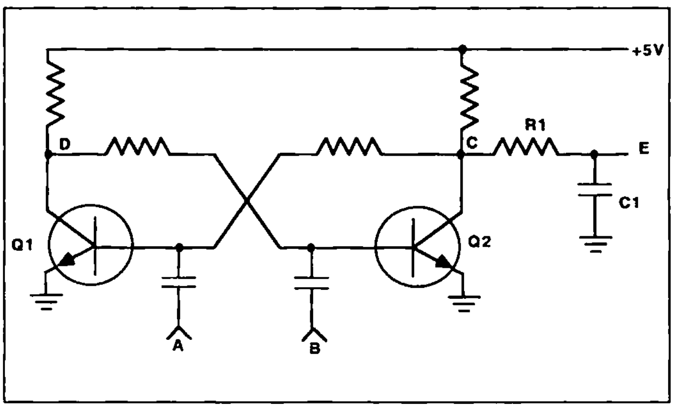


Figure 2. Basic comparator circuit.

lock on in just a few seconds. If the meter is switched to "INTERNAL," it should read about half-scale.

Even though the crystal oscillator is locked on frequency by the comparator, the board should be in a location where the temperature is fairly constant. To prevent the high-level 60 kHz signals from being picked up by the receiver input, the board should be mounted in a shielded enclosure.

The meter can be switched to monitor either the 6 MHz oscillator lock voltage (INTERNAL) or the phase difference between the comparator and your local standard (EXTERNAL). The same meter can also be

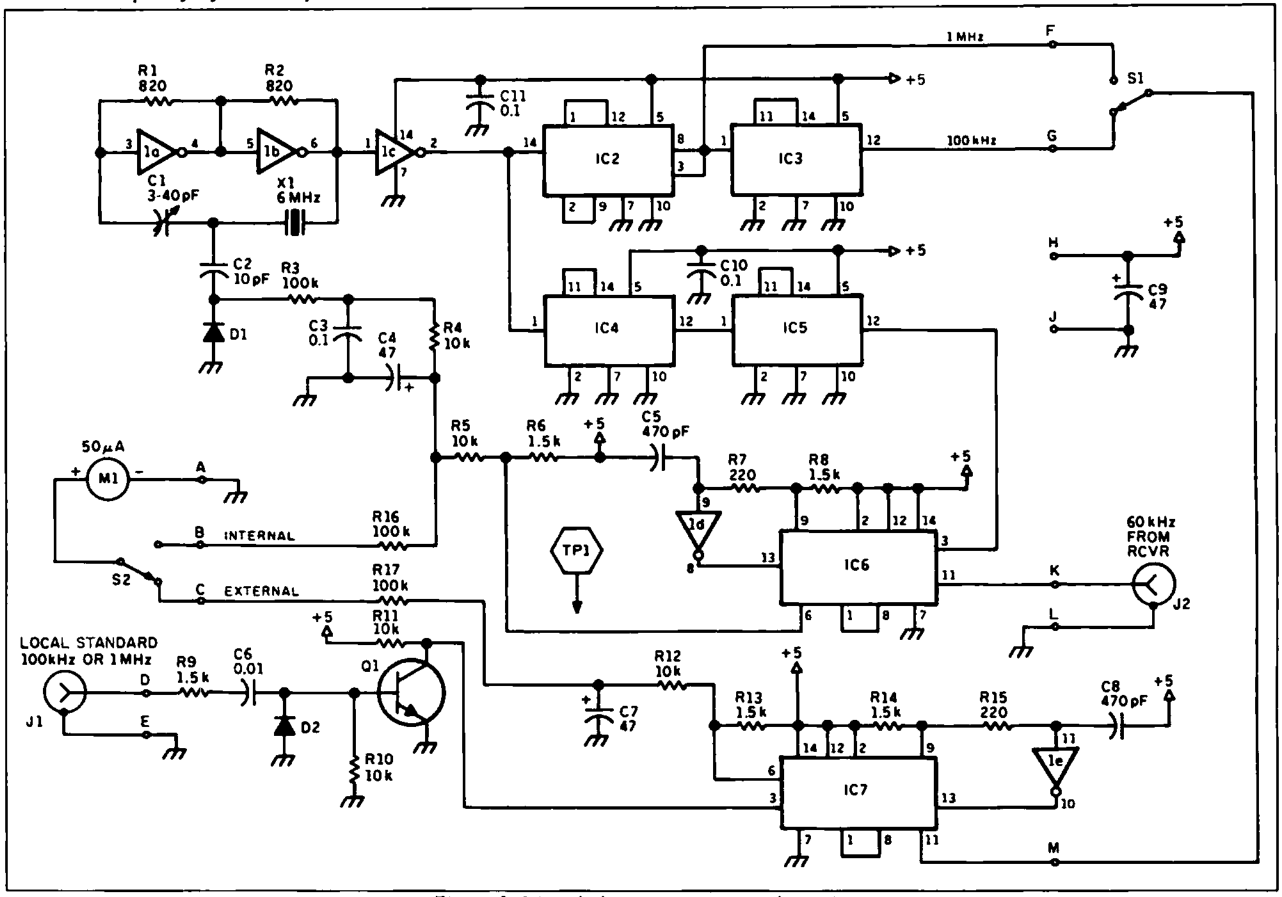


Figure 3. Digital phase comparator schematic.

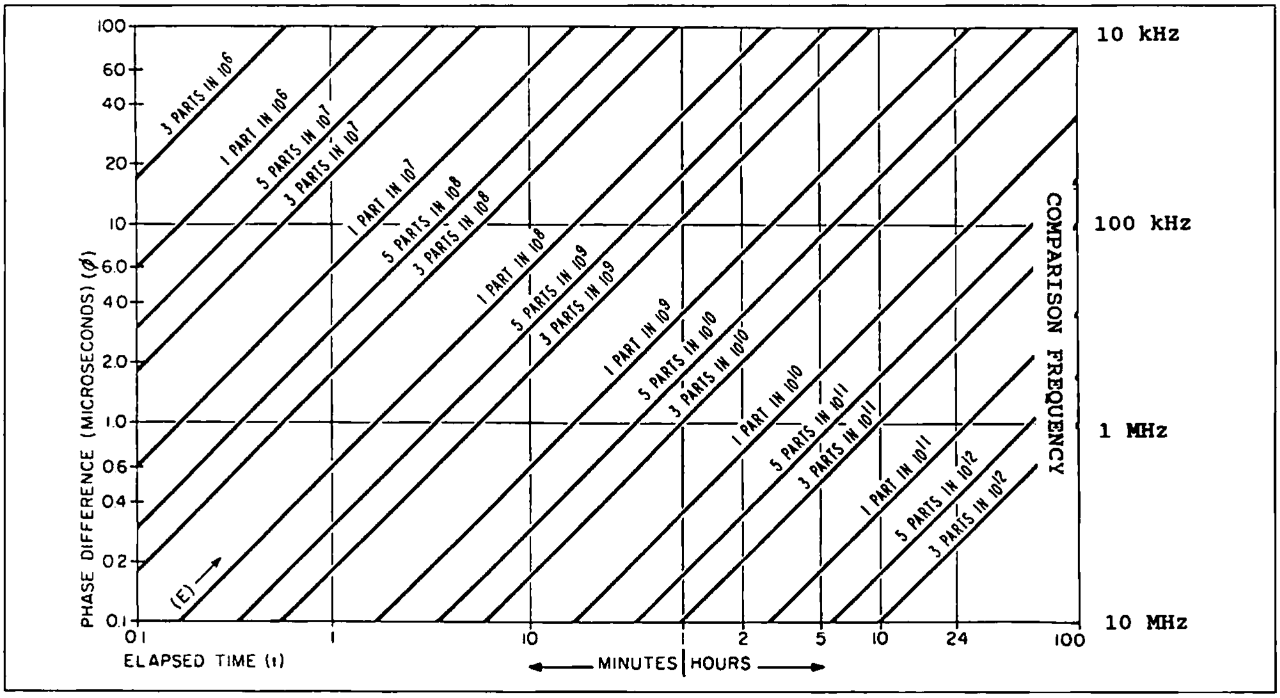


Figure 4. Phase measurement chart.

switched to be used as the receiver S-meter.

When making phase comparisons, remember that one zero-to-full-scale travel of the meter (360 degrees) is a one-cycle drift. Figure 4 is a phase measurement chart to aid in determining the accuracy of your local standard. The phase difference, or comparison frequency, is plotted against elapsed time to show the accuracy of your standard. For example, if a 1 MHz oscillator drifts one

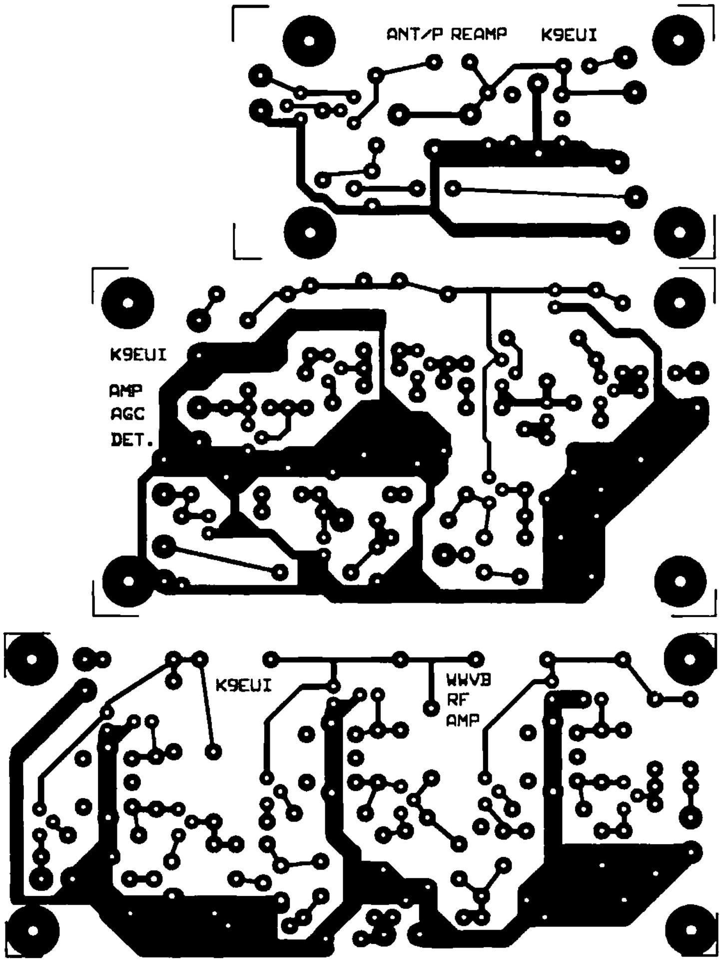


Figure 5. PC board pattern and parts placement

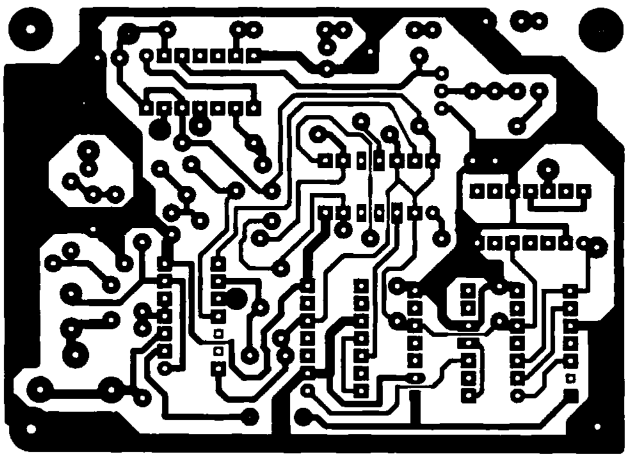
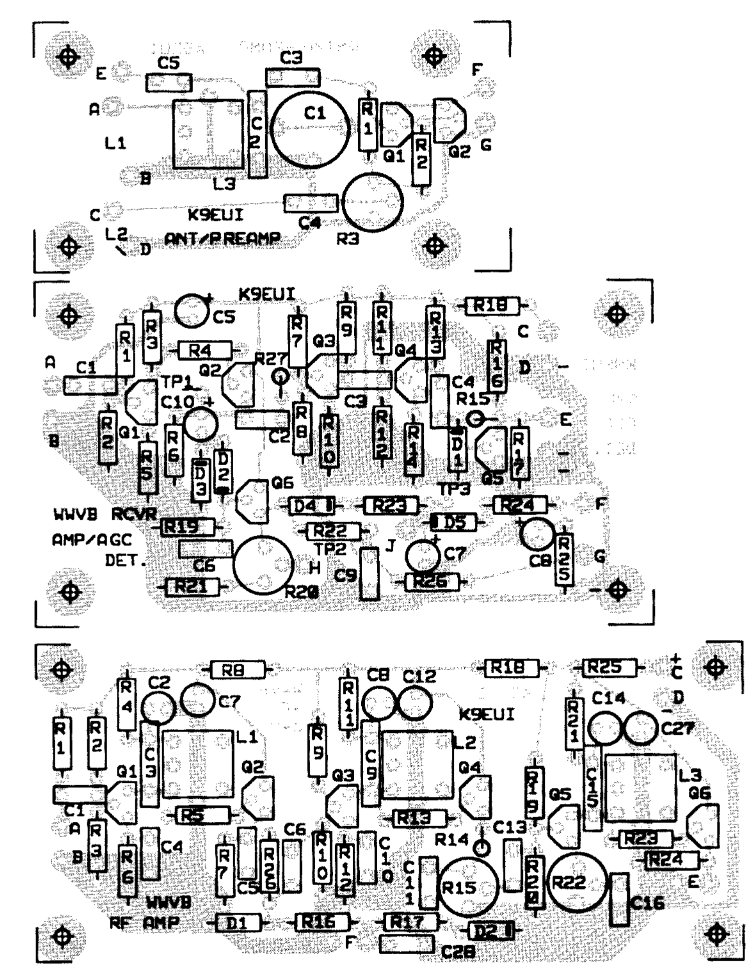


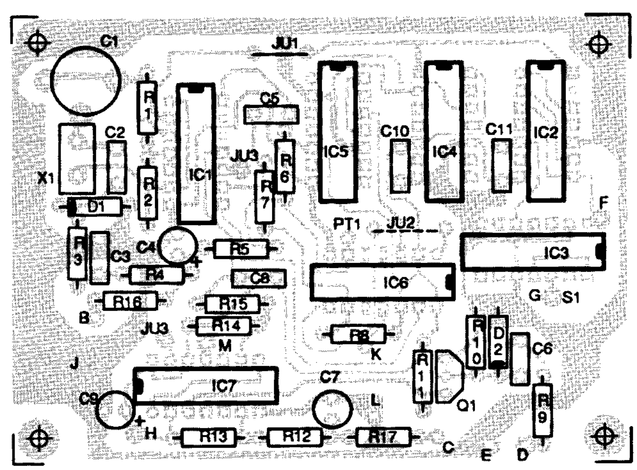
Figure 6. PC board pattern and parts placement

cycle in 20 minutes, the accuracy of that oscillator is one part in 10^9, or 0.001 ppm. If this oscillator is used as a counter time base, your measurement of a 450 MHz signal will be accurate to within 0.45 Hz!

The best times for signal comparison are mid-morning to mid-afternoon and within several hours before and after midnight. During the period of an hour or so before and after sunrise and sunset there is a phe-



for the WWVB Receiver (Part 1.).



for the Digital Phase Compatator.

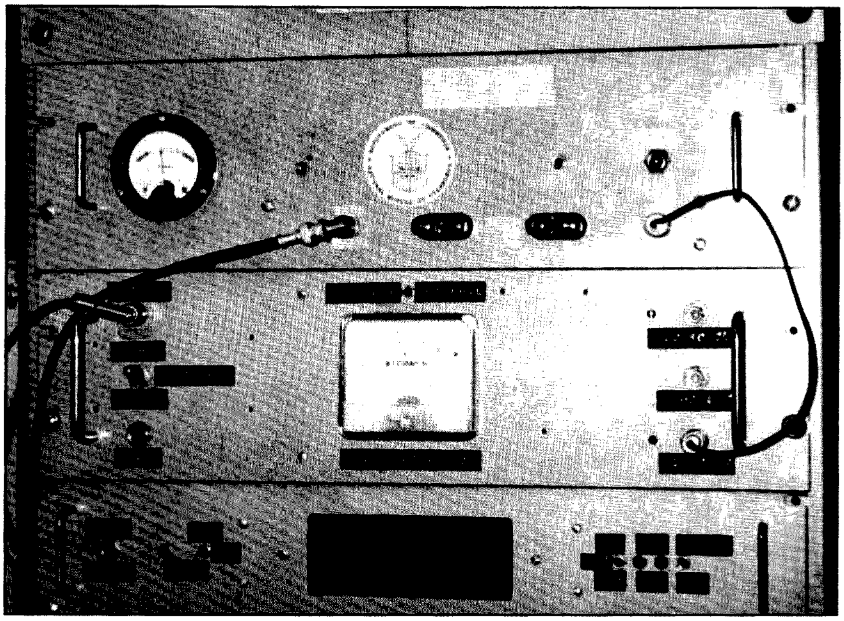


Photo A. Rack-mounted prototypes: Top unit is the 60 kHz WWVB receiver, center unit is the phase comparitor, and the bottom unit is a digital clock.

nomenon called diurnal shift when the "E" layer comes and goes. No serious measurements should be made at this time. At certain distances from WWVB, the skywave and ground-wave signals can cancel each other at this time, making the signal disappear. Remember that at 10 minutes past the hour the phase of the WWVB carrier is advanced 45 degrees, and at 15 minutes past the hour the phase is returned to its original value.

The comparator could have been made simpler by just dividing both the 60 kHz received carrier and the local 1 MHz oscillator down to the common frequency of 10 kHz. However, the observation period for the same accuracy would be 100 times as long. For this reason the synthesizer/PLL circuit using the 6 MHz oscillator was chosen.

After observing the phase comparator in action, it will soon become apparent why the WWVB signal cannot be used directly as a time base for a counter. You will notice the short-term jitter that would make frequency measurements unreliable.

The third and final part of this series dealing with using WWVB will detail the construction of a stable precision 1 MHz crystal oscillator for use as a local standard. ■

Digital Phase Comparator Parts List

(All resistors 1/4 watt)

Desig.	Value	Digi-Key #
R1,2	820 ohms	
R3,16,17	100k	
R4,5,10,11,12	10k	
R6,8,9,13,14	1.5k	
R7,15	220 ohms	
C1	3-40 pF trimmer	SG3008
C2	22 pF	P4841
C3,10,11	0.1 µF	P4525
C4,7,9	47 µF	P810
C5,8	470 pF	P4808
C6	0.01 µF	P4513
IC1	74LS04	DM74LS04N-ND
IC2-5	74LS90	DM74LS90N-ND
IC6,7	74LS74	DM74LS74N-ND
IC sockets	14-pin DIP	AE8914
D1	1N4001	
D2	1N914 or 1N4148	
Q1	2N2222 or equiv.	
X1	6 MHz parallel load 32 pF XTAL	X413

A drilled and etched PC board for this project is available for $4.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

Computer Control for Your Direct Digital Synthesis (DDS) VFO

Free yourself of the hassles of generating an accurate and stable sinusoidal signal—and more!

by Victor Morin VE1ABC

"Wow!" I exclaimed as I began reading John Welch N9JZW's article "The Techno-Whizzy 1, Part 1" (page 8 in the December 1992 issue of *73 Amateur Radio Today*). N9JZW's article describes how to build a modular multiband CW low power (QRP) transmitter that uses a new Direct Digital Synthesis (DDS) chip. Why all the excitement? Read on!

Over the years I have constructed a number of home-built rigs (both receivers and transmitters) that have one thing in common: a variable frequency oscillator (VFO). Most receivers need VFOs to generate a local oscillator (LO) signal, and transmitters need them to be freed from crystal control of a single output frequency.

The VFO designs that I used in these projects were all tank-tuned with a combination of inductors (coils) and variable capacitors, either mechanical or varactor diodes. Those of you who have also gone this route know that there are certain inherent problems with this design: temperature drift, nonlinear tuning, difficulty in eliminating the mechanical backlash in the frequency-control element, frequency pulling when a load is placed on the VFO, and the list goes on . . . For me, at least, this type of VFO design has been a royal pain!

I knew that there were alternatives, known as frequency synthesizers, to this traditional VFO construction and my interest focused on two general types: phase-locked loop and direct digital synthesis. Looking over some phase-locked loop synthesizer designs convinced me that it would probably be more of the same: LC tank circuits are used at very high frequencies and are varactor-controlled. Frequencies are regulated using phase detectors, thus generating phase noise, etc. Please don't get me wrong—I'm not saying that phase-locked loop synthesizers should be avoided—I'm simply saying that for me they didn't seem to be the way to go.

That left the direct digital synthesis approach. I read all I could on the topic and probably the best article I found is "A Direct Frequency Synthesizer" by Fred Williams in the April 1984 issue of *QST*. Surprised? This concept has been around for a long time! If you're interested in the theory behind the direct digital synthesizer, I highly recommend Mr. Williams' article, in which he provides DDS theory and describes how to build a DDS using standard TTL IC chips, a read-only memory (ROM) and a digital-to-analog converter (DAC).

This is the exciting part. When I read the "Techno-Whizzy 1" article, I knew it was the answer to my dreams! You see, I had actually begun building the Williams DDS and was contemplating building a ROM burner for it when Techno-Whizzy came on the scene—and there was a full kit available. No more chasing after parts; no more burning bits into a ROM. I could get right down to business! I ordered the DDS right away, explaining to my wife that "it would be my Christmas present from me to me."

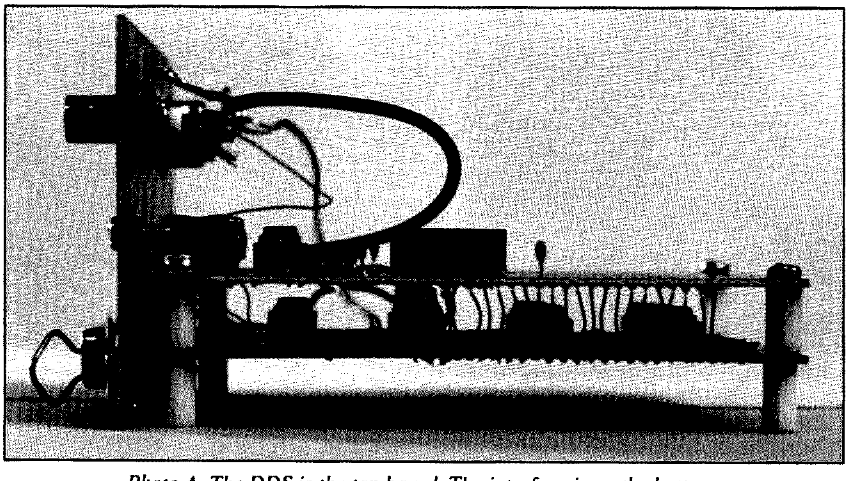


Photo A. The DDS is the top board. The interface is on the bottom.

What's So Great About a DDS?

A lot! Precise frequency control, frequency stability, no phase noise, the ability to change frequency very rapidly (frequency hop), etc. What's the price you have to pay for all this? In a nutshell, you have to be able to provide the DDS with a digital (binary) value that is proportional to the frequency of the sinusoidal signal you want your DDS to generate. To me this meant computer control, although there are other means, as demonstrated in the Techno-Whizzy 1 article where a diode matrix and switches are used.

I own an IBM-compatible AT clone computer. While waiting for my DDS kit to be delivered in the mail, I decided to design and build a hardware interface that would control the DDS from my computer and, just as important, the software driver routine that would make the DDS perform as I wanted.

The Design

I decided to use the printer interface port of my IBM-compatible to control the interface and I chose to use the simplest alternative in order to maximize my chances of success. That's why I elected to use what is in fact a parallel port as a serial port! Why?

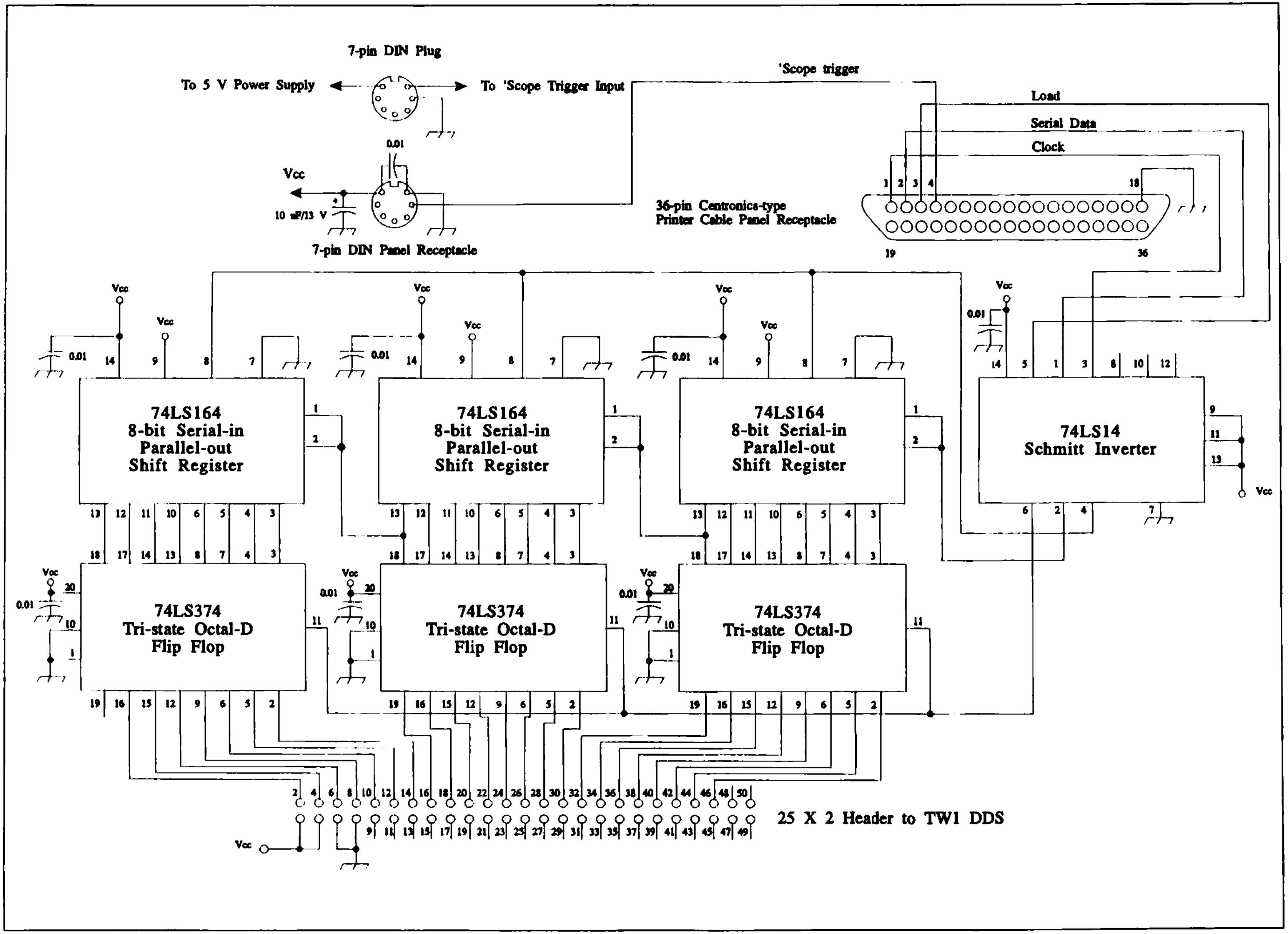


Figure 1. Schematic for the TW1 DDS computer interface.

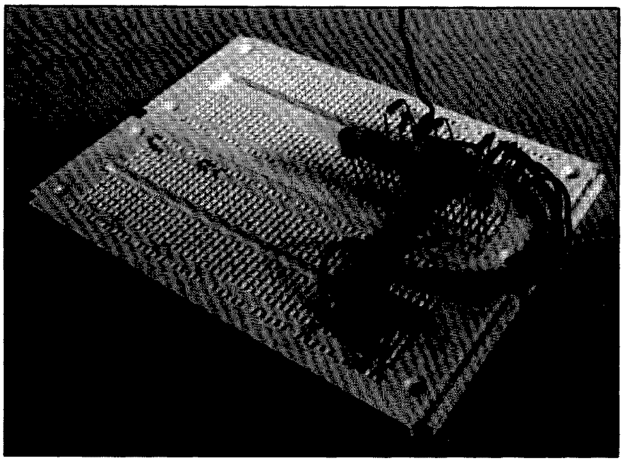


Photo B. The test jig.

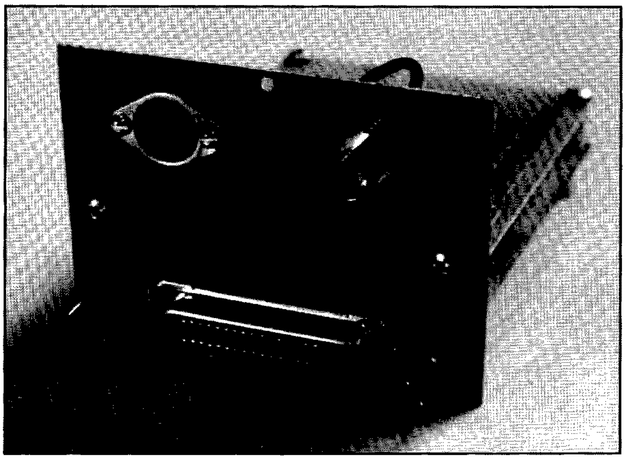


Photo C. The front panel.

Because I wanted to ensure that most of the computer output lines would not be used in solely controlling the interface (I may want to simultaneously control other devices with the computer in the future), I knew that the serial approach would slow down communications with the interface but I was willing to pay the price.

The software design was more complex than the hardware. Here is what I wanted to be able to do:

a) Enter a decimal frequency value in the computer keyboard and have the DDS generate that particular frequency (0 Hz to 22 MHz with 3 Hz resolution);

b) Have the frequency go up or down by a particular increment whenever the operator presses the up-arrow key or the down-arrow key;

c) Scan a particular range of frequencies with the frequency increment determined by the operator, and scan in either triangle mode (scan up to the highest specified frequency and then suddenly return to the lowest specified frequency for another scan) or saw-toothed mode (scan up to the highest specified frequency and then, at the same frequency interval, return to the lowest specified frequency for another scan);

d) Generate a trigger signal for an oscilloscope at the beginning of each triangle mode sweep.

Thus, I wanted it all—a VFO plus a sweep generator with trigger output. An instrument that is accurate and stable, with its output variable from DC to approximately 22 MHz. Yes, you can use the DDS to generate audio frequencies. It's like having a very expensive lab-quality instrument at a very inexpensive price!

```
                         TW1 DDS Control

Key in frequency and press ENTER, or:

"+" To Change Frequency Increment
"↑" To Increase Frequency by Value of Frequency Increment
"↓" To Decrease Frequency by Value of Frequency Increment
"*" To Enter Scan Mode

Num Lock must always be ON, Caps Lock and Scroll Lock must always be OFF
otherwise the program does not run properly.

Press any key to continue...
```

Figure 2. The instruction screen.

```
                         TW1 DDS Control

              Enter Frequency in Hz:            ?

            Current Frequency in Hz:  3,686,400

          Frequency Increment in Hz:        200
```

Figure 3. The control screen.

```
                         TW1 DDS Control

              Enter Frequency in Hz:

            Current Frequency in Hz:  6,240,000

          Frequency Increment in Hz:      5,000

           Scan Low Frequency in Hz:  5,000,000

          Scan High Frequency in Hz:  6,500,000

       Triangle (T) or Sawtooth (S):  T

   Press Any Key to Start Scan Mode, "ENTER" to Exit Scan Mode
```

Figure 4. Scan mode for the DDS.

The Hardware Interface

Figure 1 is a schematic of the hardware interface. It is straightforward and based on the Williams design. As expected, the computer software has to do all the work in driving the interface. Here is how it works: The computer generates a 23-bit binary number (representative of the frequency) that is to be presented to the DDS. This 23-bit number is sent to the DDS interface through the printer interface port and printer cable, bit by bit in serial fashion, beginning with the most-significant bit, on the serial data line. While the serial data bit is stable, the computer strobes the clock signal line, which accepts and shifts each data bit into three cascaded 74LS164 serial-in parallel-out shift registers. This is done 23 times, until all three shift registers have been loaded. The load line is then strobed, which presents the 23 bits, in parallel fashion, from the 74LS374 Tri-State Octal-D flip-flops to the DDS. The DDS then takes over and generates the required frequency. Piece of cake (sort of)! The trick is to generate the correct 23-bit binary number, and this is where the software provides all the functionality.

You will note that the load, serial data, and clock lines are "snapped up" through a 74LS14 Schmidt inverter to ensure that the leading and trailing edges of the pulses are sharply defined and jitter-free. Because the serial data pulses are inverted as a result, the software generates the 1's complement of the required 23-bit data word (every bit is "flipped"—i.e. a 1 becomes a 0 and a 0 becomes a 1).

The Software Driver Routine

The only software-generating tool available to me was Microsoft QBASIC so I didn't have much choice! I've annotated almost every line of code in the DDS.BAS program to give you an idea of what is going on in case you'd like to change things and experiment.

The mainline section of the routine begins with the usual housekeeping chores, after which the instruction screen is drawn (Figure 2). An initial frequency is sent to the DDS (I chose 0 Hz but you can change this to any frequency you like). Figure 3 shows the layout of the control screen. Two subroutines are used to generate the required 23-bit data word that is sent to the DDS—ConvertToBinary and SerialToParallel.

ConvertToBinary accepts a decimal frequency value and converts it to binary in 1's complement form (see above). It uses the age-old venerable "divide-by-two" algorithm that you may have learned in school to convert from the decimal system to binary notation.

SerialToParallel performs three chores: It scales the frequency value, calls ConvertToBinary, and pumps out the 23-bit data word to the DDS interface. Why scale the frequency value? Without going into a lot of technical details, the DDS will generate a frequency that depends not only on the 23-bit data word that is presented to it but also on its on-board clock frequency. The on-board clock chip that comes with the DDS kit has a frequency of 55 MHz, and what you have to do is scale the frequency value so that the DDS will generate the exact corresponding frequency.

Back to the mainline section of the routine. The computer sits there and waits for you to do one of a number of things:

Press the "+" key. This selects the next frequency-increment value that is contained in the frequency increment table in round-robin fashion (i.e. you return to the first frequency increment after having gone past the last). The frequency-increment value determines how much the frequency will jump when you press the up-arrow key, the down-arrow key, or while you are in scanning mode (see below).

Enter a frequency and press the enter key. The DDS generates the corresponding frequency.

Scan mode (Figure 4). Enter a scan-low frequency, a scan-high frequency and determine whether you want a saw-toothed scan or a triangle scan. The DDS generates frequencies beginning at the scan-low frequency, jumping by the frequency-increment value (see above). When the scan-high frequency is reached, the DDS either jumps back to the scan-low frequency (triangle mode) or proceeds downward, at the same rate, toward the scan-low frequency (saw-toothed mode). At the beginning of each triangle-mode cycle, a scope trigger signal is generated in case you'd like to trigger the sweep of your scope externally. The whole thing happens over and over until you decide to exit scan mode.

Press either the up-arrow key or the down-arrow key and the frequency will change upward or downward, depending on the key you pressed, by a value corresponding to frequency-increment. Hold your finger down on either key and the DDS will

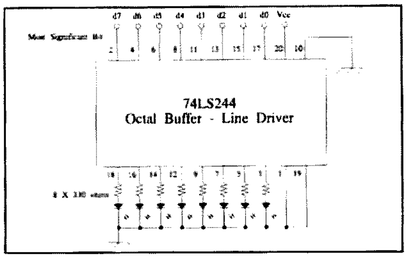


Figure 5. DDS computer interface test jig.

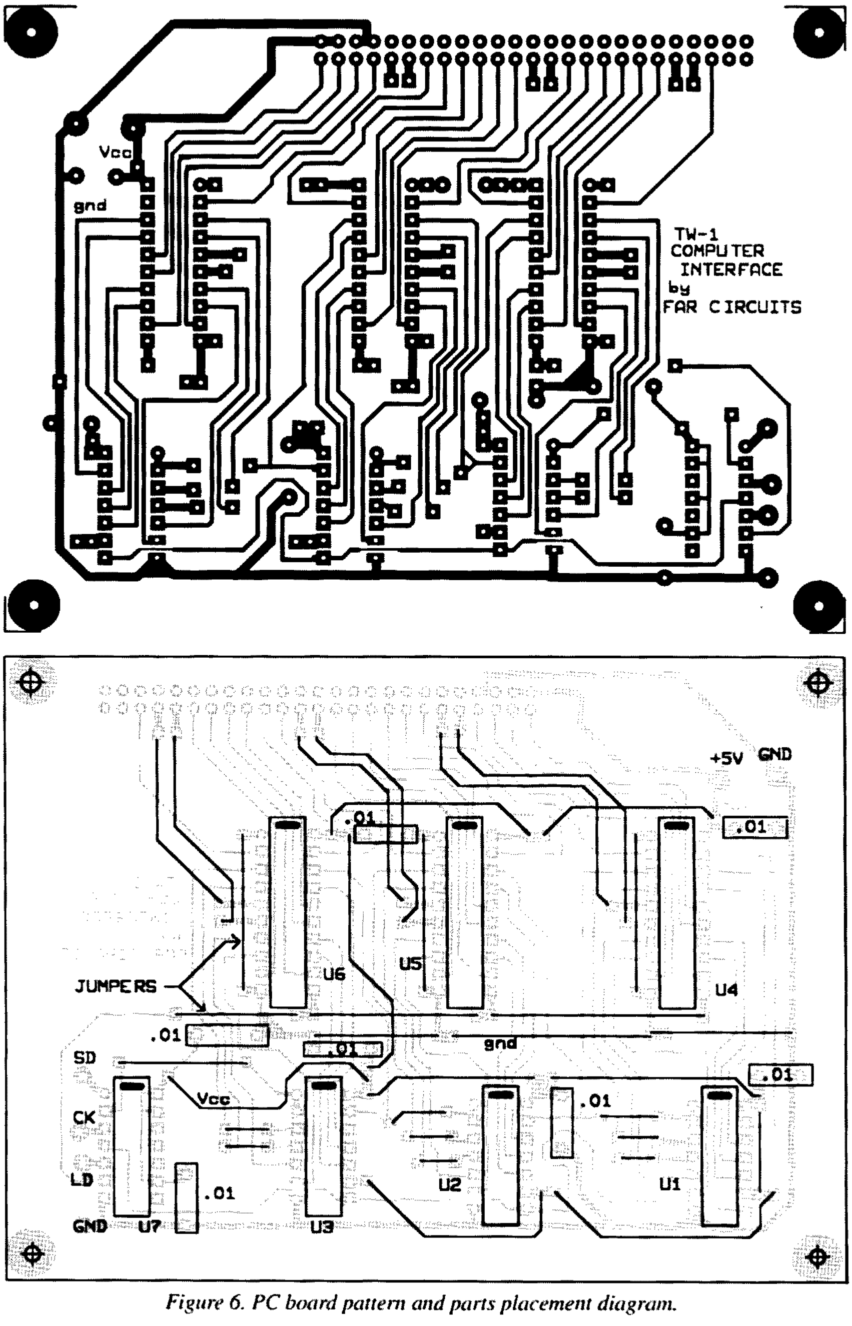


Figure 6. PC board pattern and parts placement diagram.

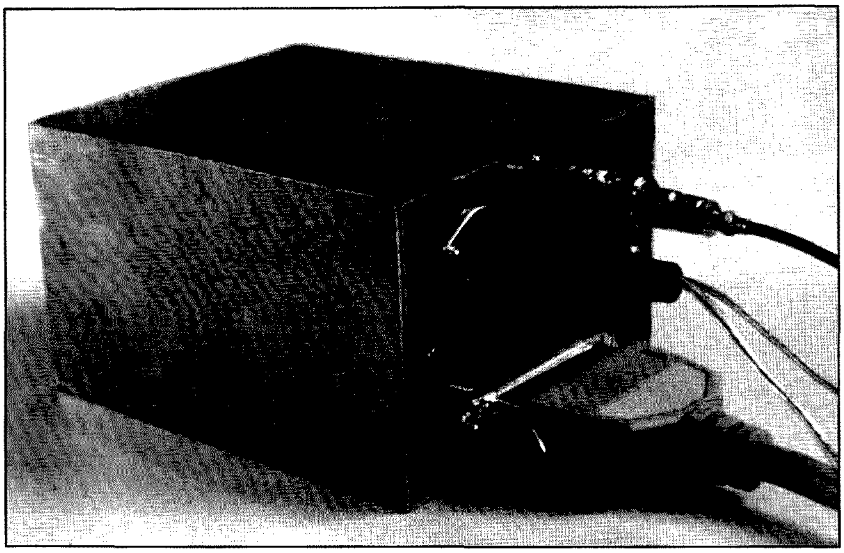


Photo D. The completed unit in its enclosure.

scan up or down as long as the key is pressed.

Construction

I decided to build the prototype interface on a printed circuit board that is exactly the same size as the TW1 DDS. This would afford a couple of advantages: The DDS board could be mounted on top of the interface board or vice versa, and the 25 X 2 headers could be made to line up exactly one on top of the other. I would simply wire one header to the other, ladder fashion and each wire perpendicular to the boards (Photo A).

Because my skills at designing and building two-sided printed circuit board are limited (non-existent would be a better choice of words), I built a one-sided board where most of the signal lines would be interconnected using 30-gauge insulated wire. If you choose to go this route, be prepared for a lot of drilling and a lot of precise soldering! Perhaps a better way to go would be to use a drilled and etched PC board available for $6.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

If you decide to make your own board, first etch the printed circuit and drill all the required holes. Install IC sockets! This will help you immensely if you have problems and have to troubleshoot in the future. Interconnect all the signal lines using Figure 1 as a guide. Install the 0.01 bypass capacitors as well as the 10 µF electrolytic capacitor. Don't put in the IC chips in their sockets yet! Check each and every interconnection with an ohmmeter looking for "opens" and pin-to-pin shorts. Only proceed to the next step once you are satisfied that the assembled printed circuit board checks out perfectly!

Check-Out

Temporarily connect the clock, serial data, and load signal lines to pins 1, 2, and 3 of the 36-pin Centronics-style printer cable panel receptacle. Temporarily connect a wire from pin 18 of the printer cable recep-

tacle to a suitable grounding point on the interface board. Plug the printer end of your printer cable (36-pin) into the receptacle leaving the other end (25-pin) unconnected from the parallel port of your computer. Check for the following continuity: pin 1 of the printer cable (25-pin end) with pin 3 of the 74LS14 chip, pin 2 of the printer cable (25-pin end) with pin 1 of the 74LS14 chip, pin 3 of the printer cable (25-pin end) with pin 5 of the 74LS14 chip, pin 18 of the printer cable (25-pin end) with ground on the interface board. Don't proceed any further unless you are convinced that the above checks out.

Next, load the DDS.BAS program into your computer. Access the SerialToParallel subroutine and disable the HoldFreq& = CLNG(CDBL(Freq&) * .3050398#) line by commenting it out with a single apostrophe at the beginning of the line. This disables scaling for the time being. Enable the statement immediately after the line that you have just disabled (HoldFreq& = Freq&). To provide display of the 23-bit data word on your monitor screen, access the ConvertToBinary subroutine and enable the following line:

LOCATE 23,1: FOR i% = 22 to 0 STEP -1: PRINT BinaryValue(i%);:NEXT i%.

This causes the 23-bit word to be displayed in binary at the bottom of the screen. Remember that this is the 1's complement of the number entered, however.

You are now going to check out your unit by using eight LEDs to ensure the correct bit pattern is being generated by the interface. (You could use 23 LEDs at once, if you like). Build a test jig based on Figure 5. I used an IC proto board because the test jig is only used once for check-out purposes (Photo B). Temporarily connect the eight test jig inputs to the eight least-significant-bit outputs of the interface (outputs 32 to 46 to inputs d7 to d0).

Populate your printed circuit board with its ICs. Connect the computer printer cable to the parallel port on the printer. Provide 5 volts to the interface board and the test jig. Run the DDS.BAS routine and key in a frequency of zero Hz. All eight LEDs on the test jig should be out. All the bits at the bottom of the screen should be 1s. Now key in a frequency of 255 Hz. The inverse should happen and all eight LEDs should be lit, the eight least significant bits on the screen should all be 0s.

Next, unsolder the eight test jig inputs and temporarily solder them to outputs 16 to 30 of the interface (30 to d0, 28 to d1, etc.). Key in a frequency of 65,536 Hz. All eight LEDs should be lit. Key in a frequency of zero Hz. All eight LEDs should be out. Enter other values to see the generated bit patterns.

Finally, disconnect the input leads to the test jig and re-connect the seven least significant test-jig inputs to the seven most-significant-bit outputs of the interface (2 to d6, 4 to d5, etc.) Leave d7 unconnected and ignore the left-most LED. Key in a frequency of zero Hz. All seven LEDs should be out. Key in a frequency of 8,388,607 Hz. All seven LEDs should be lit. You will notice that the bits displayed at the bottom of the screen always show the inverse of the bits represented by the LEDs.

If things don't check out, the particular bit(s) that is (are) not functioning properly will give you a hint as to where the trouble might be on the interface. Use your analytical skills to zero in and determine where the problem lies. Once everything is OK, disconnect the test jig.

Final Assembly

I assume that you've constructed and checked out your TW1 DDS board before proceeding to this point. Mount the DDS board on top of the interface board using half-inch threaded spacers (photo A). Solder the 23 signal lines (outputs 2 to 46) from the interface board to the DDS board and check the continuity of the 23 lines from one board to the other. Use 22 gauge hook-up wire to provide Vcc and ground to the DDS

board. Next, attach the combined units, using two small-angle brackets, to a front panel. My front panel holds a seven-pin DIN round receptacle, a 36-pin Centronics-type printer cable receptacle, and a BNC single-hole-mount chassis jack (Photo C). Solder the three signal wires leading from the printer cable receptacle to the interface board. I use the seven-pin DIN receptacle to provide power to the unit and to provide the scope trigger signal to the outside world. Solder the scope trigger line from pin 4 of the printer cable receptacle to an unused pin on the DIN receptacle. Connect the BNC jack to the DDS output with a short length of miniature 50 ohm cable. You may wish to build an enclosure for the unit in order to provide shielding. I built mine using double-sided printed-circuit board (Photo D).

> ***Parts Information***
>
> A copy of the DDS.BAS driver routine software written in QBASIC can be downloaded free from the *73* BBS at (603) 924-9343.
>
> The DDS VFO module kit is available from Elktronics, 12536 T.R. 77, Findlay OH 45840; (419) 422-8206.
>
> The receptacles, capacitors, IC chips and sockets for the computer interface are all available from Digi-Key at (800) 344-4539, or from other major distributors.
>
> The eight LEDs used in the test jig can be any LEDs that you have in your junk box.
>
> The use of a manufactured computer cable is not mandatory—you can build your own cable using receptacles of your choice.
>
> Drilled and etched PC boards are available for $6.50 plus $1.50 S&H from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

Calibration

Calibration? But there aren't any trimmer capacitors! Do you remember the scaling factor in the software routine that I mentioned earlier? Well, it's now time to "tweak" the scaling factor to your on-board DDS clock. Go back to the DDS.BAS program and disable the program lines that you used for checkout purposes. Also remove the single apostrophe in front of the following line: HoldFreq& = CLNG(CDBL(Freq&) * .3050398#). Now connect a frequency counter to the output of the DDS, connect the unit to a 5 volt power supply, connect the printer cable between your computer and the DDS, and fire everything up. Begin by keying frequencies that are multiples of 1 MHz and observe the values on the frequency counter. If you have an oscilloscope, you may also want to view the purity of your sinusoidal signal. Assuming there are no problems in your soldering and wiring job, you should get frequencies that are close to those being keyed in and that have a very high degree of purity. Once you've gone up to 22 MHz and everything looks OK, play with the unit by entering oddball frequencies. The DDS should react accordingly and this should be reflected on your frequency counter.

The adjustment of the scaling factor should now be obvious. If your input frequency is consistently high compared to the frequency counter, reduce the scaling factor, and vice versa. By how much? I don't know. I just did mine by trial and error until the frequency counter read dead-on and then I built a direct conversion receiver using the DDS as the LO to zero-beat it against WWV. I think the accuracy of my unit is within 50 Hz, if not better.

Operation

I tried to make operation of the unit as intuitive as possible and I hope that the instruction screen (Figure 2) is self-explanatory. Those of you who are accustomed to Windows-based applications won't find this very fancy but, in my defense, all I can say is that the proof is in the puddin'. Speaking of Windows, you will find that the scanning process is slowed if the software is run in a Windows environment. If you want maximum scanning speed from your computer, run DDS.BAS in an MS-DOS environment.

What Next?

I encourage those of you who are interested in software design to combine forces with the hardware types, and vice versa. The software that I have developed is first-generation and I have placed it in the public domain. Play with it. Change it for the better! A machine-language routine to speed up the scanning process might be interesting. The hardware interface is nothing fancy. How about someone developing a true parallel interface, or using adder chips on the interface board again to speed up the scanning process? How about frequency hopping or spread-spectrum applications? The sky's the limit!

As for me, I'm going to continue my quest for the Holy Grail: building an up-converting general-coverage HF receiver (with FM, of course) using the TWI DDS as one of the fundamental building blocks. Hmm . . . I wonder if cheap HF crystals can be used at their third overtone to build a ladder filter at approximately 45 MHz? The TWI DDS in scanning mode, heterodyned to VHF, will help me find out. I hope I have as much success with that project as I did with this one.

Bench notes from John Welch N9JZW, designer of the TW-1 DDS rig.

Since I built the TW-1, people have been asking me why I didn't make it computer-controllable. Frankly, I didn't want to, given my other plans for expansion. However, there *is* a need, and this board fills it well.

I built the project on a PC board, which is shown in the adjacent photo. It went together smoothly, taking about an evening's work to assemble. There are a lot of jumpers, but they are plainly marked and should cause you little trouble. Do socket all the chips, as I had one bad chip which kept mine from working the first time. A quick change took care of that, though, and it has worked since then.

Be careful about soldering, and make sure you have the chips inserted the right way. The parallel port on an IBM PC isn't protected, and it is possible to blow up a chip if you get some wires crossed. Just be sure to double-check your wiring, as the article says.

The program will only work if you use a parallel port at address 3F8 (hex). The port on an old monochrome video board is *not* at this address, but for most computers this is LPT1 and should cause no problem.

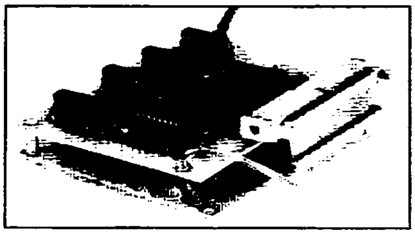
There is an easier and faster way to calibrate the frequency. You'll need a calculator and a frequency counter that can handle 55 MHz signals. Measure the frequency of your TW-1's oscillator (it's available on the jumper on the DDS VFO board). The "fudge factor" should be 16777216 / (your oscillator frequency in hertz).

My oscillator runs at 55000230 Hz, so my value is 16777216 / 55000230 = 0.3050390153. This should put you dead on frequency the first time you run the program.

If you don't have a frequency counter, don't worry—the 55 MHz oscillators are very accurate and stable, and you'll be no more than about 50 Hz away from where you think you are over almost all bands.

There is an enhancement I'm working on for the TW-1 that will increase your upper range from 21.5 MHz to slightly over 30 MHz. This will require a small change to the program, and another jumper to be added to this board. FAR Circuits is adding a pad on pin 48 of the header for this.

When I get this board functional, I'll also let you know what to jumper and what to change in the program. 'Til then, hope you have fun with your TW-1 Direct Digital Synthesized rig. 73 de N9JZW.



Number 7 on your Feedback card

ASCII-to-Morse-Code Interface

Let your keyboard do the work.

by Steven Weber KD1JV

Do you have a computer in your shack and only use it to log QSOs, send packet or play games? This simple weekend project will allow you to send and receive Morse code with your computer as well. It will not decode Morse code for you (that's cheating!), but your fingers will never have to leave the keyboard.

Packed Full of Features!

The ASCII-to-Morse-code Interface (or A.M.C.I.) will convert ASCII characters into Morse code at the speeds of 10, 13, 15, 17 or 20 wpm, as selected from the keyboard. It has a 30-character input buffer, a message memory of 50 characters and it even has a built-in electronic keyer function so you can use your paddle instead of the keyboard, should you desire.

Operation

When first powered up, the A.M.C.I. generates a short beep and outputs the message "***RECEIVE***" to your computer screen. It is now in the receive echo mode. Whatever you type on your keyboard will be echoed back to the screen.

When you type the the character "+" the A.M.C.I. switches into the transmit mode and outputs the message "***TRANSMIT***10 WPM***" to the screen. What you now type is echoed back to the screen and then converted into Morse code. The A.M.C.I. recognizes letters (upper or lower case), the numbers 0-9, and the punctuation marks: period, comma, dash, and question mark. Any character not in the Morse look-up table will simply be echoed back to the screen. The code speed is selected with the characters # (10 wpm), $ (13 wpm), % (15 wpm), ^ (17 wpm) and & (20 wpm). The selected speed is outputed to the screen as a message, i.e. "***17 WPM***." The speed can be changed at any time in the transmit mode. Typing "[" doubles the spacing between letters and words. Typing "]" returns the spacing to normal. This provides an easy way of slowing down the code speed when necessary because of QRM. The character "!" toggles the A.M.C.I. back into the receive mode. The ENTER key generates a carriage return and line-feed response to the screen. The space key will generate the proper inter-word spacing.

You may want to make a template for your keyboard to label the function keys until you've got them down pat.

The A.M.C.I. has a 30-character input buffer. The characters are echoed back to the screen as you type. If you are a good typist there is a possibility you will fill up the buffer. The A.M.C.I. will not allow you to overwrite the buffer. Your computer's bell will sound if the buffer is full, informing you to stop typing for a minute and let the buffer send out some characters. It is best to type only a few words ahead and then pause for a few moments before continuing.

Message Storage

The A.M.C.I. can store a message of up to 50 characters in length. Spaces count as characters. Typically you would use this to store a "CQ" message, but of course you can put whatever you want there. To store a message, type "*." The message "TYPE MESSAGE 50 CHRS MAX" will then appear on your screen. Now type in your message. Mistakes can be corrected by using the backspace key. If you enter in too many characters, the message "**BUFFER FULL**" will appear on the screen and return you back to the "type message" message. Enter a "!" as your last character. The A.M.C.I. will then respond with the message "** END OF MESSAGE**" to the screen and exit back to the receive mode.

To output the message, enter "@." The A.M.C.I. will now output the message at the code speed currently selected. The characters of the message are written back to the screen one at a time as they are sent. You can send the message in either the receive mode or the transmit mode and you will return to the mode that you were in when the message output was selected. This allows you to send the CQ message while in the receive mode and return there automatically to copy an answering call. Or you can use the message to send your name and QTH while in the transmit mode and then continue sending when the message is finished.

The Electronic Keyer Function

The electronic keyer is active at all times in the transmit mode. Its speed is the same as that currently selected from the keyboard. It has dot and dash memory, sensed at the end of the dot or dash and before the space. This makes for glitch-free operation. If both paddles are squeezed together at the same time it will send a dot-dash string that starts with whatever made contact first, the dot or the dash.

As an option you can add an N.O. pushbutton switch and five LEDs on your front panel. If you hold in the PB switch (which I labeled "KYR SPD"), then turn the power on, you will now be in a stand-alone keyer mode. This allows you to use the keyer function without having to turn on your computer first.

The LEDs indicate the speed that the keyer is set to. Pushing the PB momentarily will advance the keyer speed. This function operates only in the stand-alone keyer mode, but the LEDs will also indicate the speed that the A.M.C.I. is set to during normal keyboard operation.

CPU port bit P1.4 (pin 5) is set low in the stand-alone mode. You can add another LED (with a 330 ohm series resistor) to the front panel to indicate this mode if you want to.

The Circuit

The heart of the A.M.C.I. is an 8031 microcontroller. The 8031 has been an industry standard for some time now and is still used in many products. The 8031 is an 8-bit device that has a built-in serial port, 128 bytes of internal user RAM, 128 bytes of internal function registers, two timers, a Boolean processor, 16 I/O ports, and can address up to 64K of program memory and 64K of external RAM. The instruction set is designed so that the program code is very efficient. The program for this project is a little over 1.5K

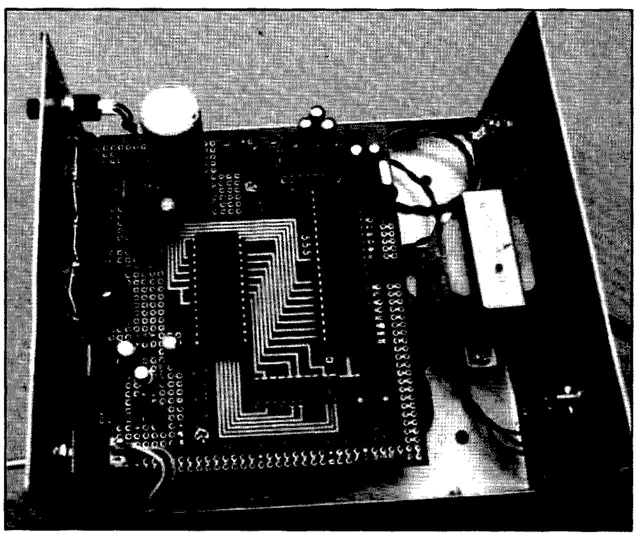


Photo A. Under the hood of the A.M.C.I..

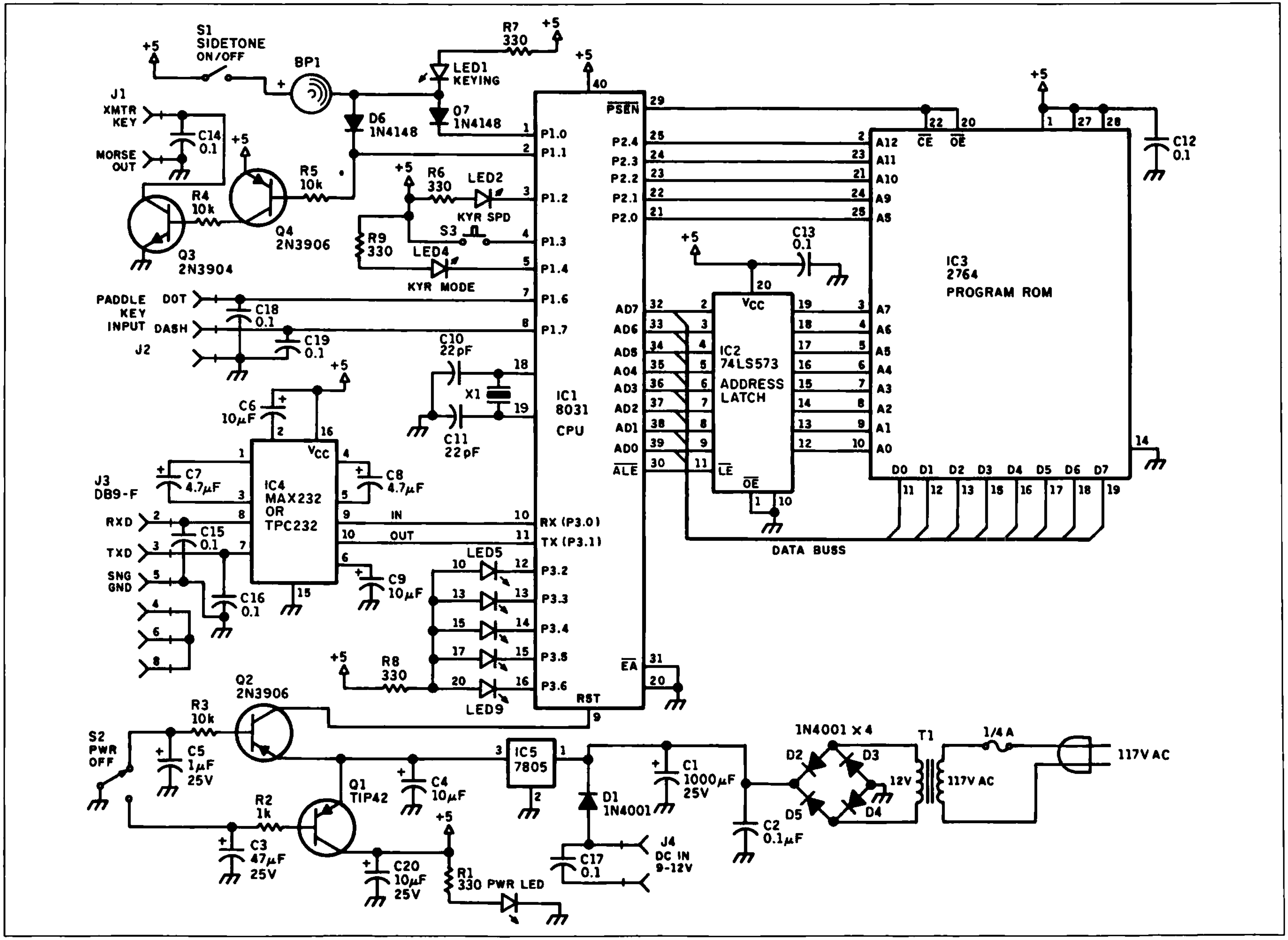


Figure 1. Schematic for ASCII-to-Morse Code interface.

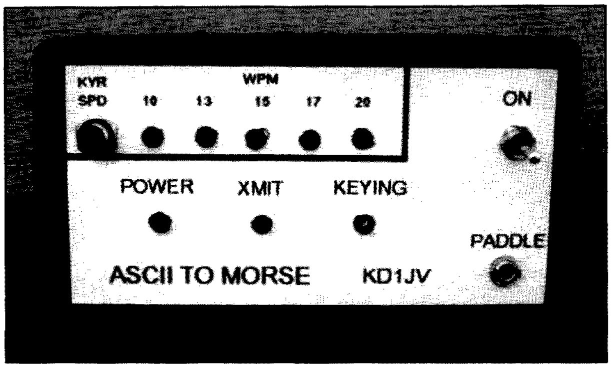


Photo B. The completed project.

bytes long, much of which is the Morse look-up table and ASCII jump table.

The 8031 multiplexes the lower eight address bits out on the data bus. A 74LS573 is used to latch this address information. A MAX 232 IC (or TPC232) is used to interface the RS-232 input and output to the 8031 serial port. The MAX 232 has a built-in voltage doubler and inverter to generate the +10 and -10 volts required by RS-232 ports. The CPU's clock is 11.0592 MHz. This frequency was chosen by the 8031 developers so that standard baud rates can be easily generated with the 8031's internal timers.

The power supply, power control circuit, a piezo beeper, a number of LEDs and transmitter keying transistors complete the circuit. The keying circuit is designed for solid-state rigs. If you have a tube transmitter, try using an optoisolator to drive a high voltage power transistor, or add a relay to key your rig.

The power supply for the A.M.C.I. is on all the time. Power to the main circuits is turned on and off using a simple PNP transistor switch. When power is turned off, another PNP transistor is turned on to supply power to the RST pin of the CPU. This keeps the internal RAM alive so that your stored message doesn't have to be entered every time the unit is turned on. The capacitors C3 and C6 keep their associated transistor turned on when the power switch is thrown long enough to ensure proper power down, power up reset of the CPU.

If you don't mind entering the message every time you turn the unit on, these parts can be eliminated and the AC line switched on and off. If you go this way, a 2.2 μF cap must be installed between +5 and pin 9 (reset) on the CPU.

Communicating to the Interface

The serial port of the A.M.C.I. is set to 1200 baud, 8 bits, no parity and 2 stop bits (1200,8,N,2) and it recognizes standard ASCII. To talk to the A.M.C.I. you must have a communications program of one sort or another installed in your computer. The TELECOM program that came with my TANDY laptop works just fine. Other programs such as PC TALK, PROCOM, and the like will also work. As long as you can make a direct connection to your serial comm port you will be all set. By using one of these communications programs you can also save your QSOs as a file on disk or floppy. For those of you who don't already have a communications program, a public domain program that emulates a dumb terminal will be supplied along with the source code for this project.

Construction

There are three ways you can build this project:

First, you can "prototype it" using the perf board and wire wrap method.

Second, you can buy an SBC (Single Board Computer) kit from Suncoast Technologies (see the Parts List). The kit comes

with the basic computer parts, i.e. CPU, latch, RS232 chip, crystal, caps, sockets, and PC board. The PC board has enough room on it to mount the power supply and I/O parts. Also, as a bonus, you get a disk with all the programs you need to write your own 8031 programs. That is how this project was developed.

Finally, you can use the PC board designed for this project. The board is single-sided, making it possible to home-brew should you desire. All the parts can be found between JDR Microdevices and Radio Shack.

Please note that IC2 and IC3 have pin 1 facing "down" and that there are 16 wire jumpers on the board. Use #24 stranded wire to connect the various switches and jacks to the board. If possible, use 1/8 watt resistors as they will fit the board better than 1/4 watt.

Summary of Keyboard Commands

+	Go to transmit
!	Go to receive
*	Enter message mode
@	Transmit message
#	Set 10 wpm speed
$	Set 13 wpm speed
%	Set 15 wpm speed
^	Set 17 wpm speed
&	Set 20 wpm speed
[	Doubles code spacing
]	Resets to normal spacing

Parts List

*	IC1	8031	8-bit controller
*	IC2	74LS573	Octal bus latch
*	IC3	2764	8K EPROM
*	IC4	MAX232 or TPC232	RS232 interface
*	IC5	7805	5V-to-220 voltage regulator
		Heat sink for regulator	
	Q1	TIP42	TO-220 PNP power transistor
	Q2,4	2N3906	PNP small signal transistor
	Q3	2N3904	NPN small signal transistor
	D1-5	IN4001	1 amp rectifier diodes
	LED 1-9	Red LED	
	D6,7	1N4148	Small signal silicon diode
*	XTAL	11.0592 MHz	Microprocessor clock crystal
	C1	1,000 µF/25V	Aluminum electro cap
	C2,C12-19		0.1 µF/50V Mono ceramic cap
	C3	47 µF\25V	Aluminum electro cap
*	C4,6,9,20	10 µF\25V	Aluminum electro cap
	C5	1 µF/25V	Aluminum electro cap
*	C7,8	4.7 µF\25V	Aluminum electro cap
*	C10,11	22 pF	Ceramic disk
	R1,6-9	330 ohm 1\8W	Carbon film resistor
	R2	1k 1\8W	Carbon film resistor
	R3-5	10k 1\8W	Carbon film resistor
	S1,2		DPDT toggle switch
	S3	N.O.	Push-button switch
	T1	115V TO 12.6 VAC 300 mA	Transformer (Radio Shack #273-1385)
	J1	1\4-inch	Open circuit phone jack
	J2	1\4-inch	Open circuit stereo phone jack
	J3	DB9	9-pin female D jack
	J4	Power jack	
	BP1	Piezo beeper	(Radio Shack #273-065)
	F1	1\4A	Fast blow fuse and holder

* PC board: A drilled and etched PC board is available from the author at P.O. Box 140, Gorham, NH 03581 for $11 ppd.

Box		Radio Shack #270-253
(4)	11\16" Standoffs	Radio Shack #276-195

* Part of Suncoast Technologies Kit #70691C, $27 + 2.90 S+H, P.O. Box 5835, Spring Hill FL 34606; Tel. (904) 569-7599.

JDR Microdevices, 2233 Samaritan Drive, San Jose CA 95124; Tel. (800) 538-5000.

The 7805 voltage regulator requires a small heat sink.

As this is a digital device, it should be mounted in a metal box and bypass caps added at all the input and output jacks. This keeps RFI from your transmitter from getting into the A.M.C.I. and RFI from getting out of it. I built mine into a Radio Shack #270-253 box.

If you add the speed-indicating LEDs it would be a good idea to mount them on a small strip of perf board.

You can build in an AC supply like I did or use one of the 9 VDC, 500 mA wall-mount plug-in type supplies that are so common today. Don't forget to jumper pins 4, 6, and 8 together on the DB9 jack. If you don't, your computer will not recognize that there is a device connected to it. I mounted the DB9 jack on the back of the box and used a shielded female-to-male DB9 extension cable between my computer and the A.M.C.I.

The front panel artwork was created on my computer and copied onto Graphic Applique film, using a technique described by Marion Kitchens K4GOK in the May 1993 issue of *73*.

If you don't need the sidetone you might want to add a switch to switch in or out the beeper. This way you can use the A.M.C.I. as a code practice generator. Just about anyone can send code to you using the keyboard. A good two-finger hunt-and-peck typist will have no problem even at 20 wpm. Or you can record the code on a tape recorder for practice later.

Getting the Program Code

One of the problems with building a computer project like this one is getting the program code. It is not practical to publish the program code in the magazine, so you will just have to send away for it or download it with your modem from the *73* BBS (603-924-9343).

A 3-1\2" disk with the assembly source code listing, INTEL HEX file, binary file and the dumb terminal program called "THE TERMINAL" is available from me for $3 postpaid (Box 140, Gorham NH 03581). If you can't blast your own ROMs, I can also supply a preprogrammed 27C64 EPROM along with the disk for $10.

Last Words

Since the only mode I work is CW, this project has been very handy. No longer do I use up reams of paper, and my fingers don't get numb from having a death grip on the pencil. I hope this project helps you to get more use out of your computer and enjoy CW more often. So if you've never had anyone tell you "great fist—pleasure to copy," this project is perfect for you! Let's all help keep CW alive and well.

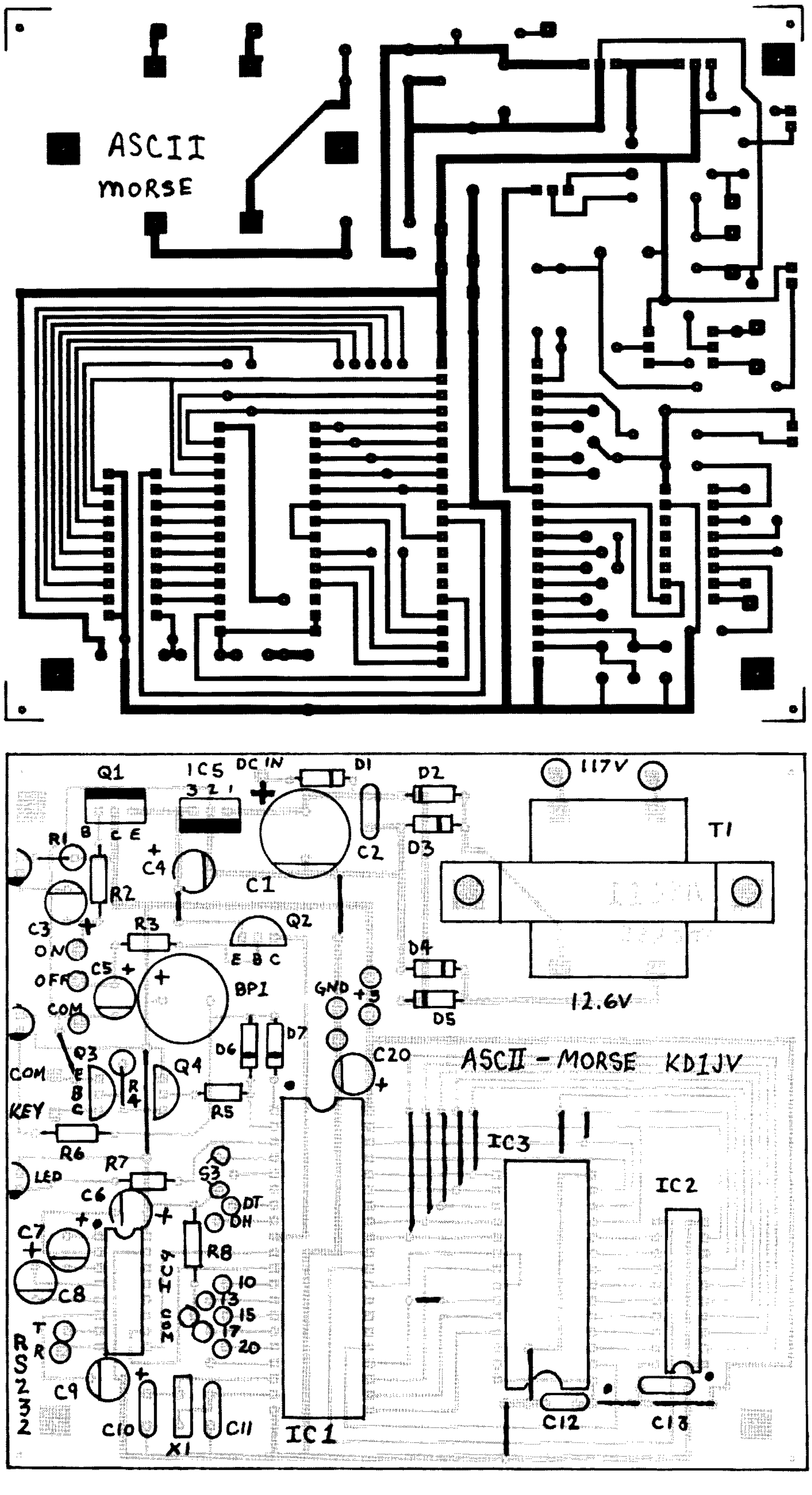


Figure 2. PC board foil pattern and parts placement diagram.

Standardize Your Microphone Connectors

A one-plug-fits-all solution you can easily build.

by Klaus Spies WB9YBM

My initial reason for standardizing the microphone connectors on all of my transceivers was to allow interchangeability of home-brew station accessories among my radios. It also occurred to me that, in the event of a microphone failure during emergency communications, being able to grab the nearest convenient microphone (and having it work right away) would also be a big advantage.

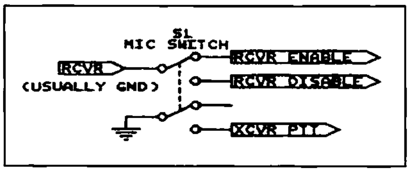


Figure 1. Typical microphone switch in a CB transceiver.

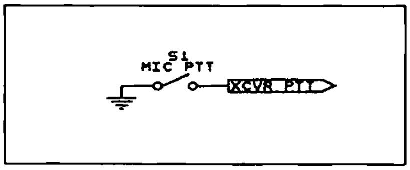


Figure 2. Microphone PTT switch for most ham transceivers.

A Look at Connectors

Older radios in my shack had three-pin connectors, while the majority of more modern radios have four pins, with the fourth pin being unused. Standardizing to the more modern four-pin connector made the most sense, since the older three-pin connectors are not commonly available. The four-pin connectors can be found at most parts stores, hamfests, and the like.

Having the fourth pin unused turned out to be a blessing in disguise. When requiring a signal from the squelch to trigger a tape recorder (for logging), or to enable the PTT of another transceiver in a link, it was very easy to build and install an interface circuit right inside of the radio (see page 27 of the December 1988 issue of *73*). That signal could be conveniently brought out through pin four.

A Look at Wiring

Deciding beforehand on the wiring scheme is helpful. In my case, the determining factor was my HF rig; because it seems like the most complex rig in my shack, it was the transceiver I was least likely to open up and modify. Using pins one through three as ground, audio, and PTT, leaves pin four open for accessories, putting the least important function last. The order of the other three is not really important as long as there's consistency in the entire hamshack.

The only fly in the ointment is with converted CB transceivers. Even those that work with the microphone removed (some older ones do not) had microphone switches that were DPDT, one side toggling the PTT to ground, the other toggling some point in the transceiver between the microphone and the receiver circuit (Figure 1 shows the typical example of this). By comparison, the standard switching of amateur gear is a bit more straightforward (see Figure 2).

Figure 3 shows how a CB can be made to operate with a typical ham microphone. If the "RCVR ENABLE" of Figure 1 (the N.C. on Figure 3) is connected to anywhere but ground, connect pin 4 of U1 there, instead of ground (the same holds true for RCVR DISABLE on Figure 1 and N.O. and pin 11 on Figure 3).

Unused gates of the ICs should be connected to +12V or ground, as convenient. I installed the circuits I built right into my transceivers, as far as possible from the transmitters' final amplifier. This ensures good shielding of the circuits from the RF in the hamshack, and avoids the high RF in the rigs' PA.

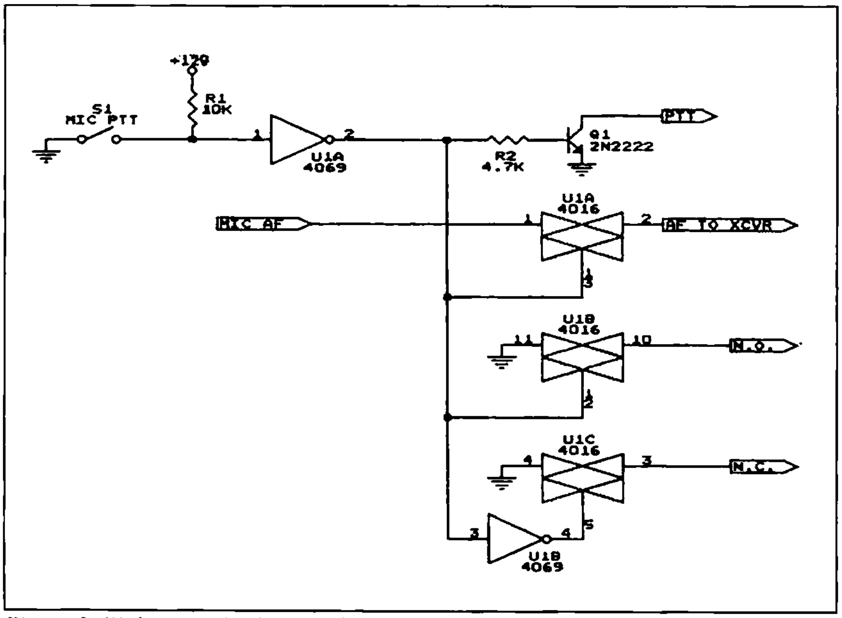


Figure 3. With a standard microphone switch, this circuit will interface to most CB transceivers.

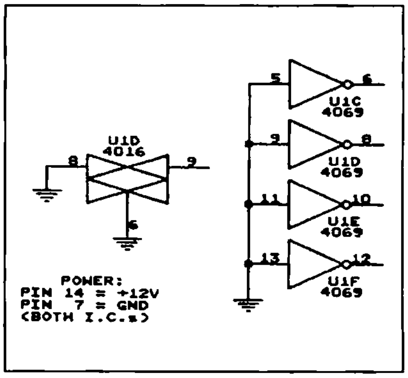


Figure 4. Unused gates should be connected to +12V or ground.

Folding Three-Element 2 Meter Quad

Finds fox, folds, fits in trunk.

by John E. Myers WX8G

I've been interested in radio direction finding for about six years and I've always had good results with my home-brew five-element yagi. Its shortcoming, however, was that it was too big to fit into the trunk of our car. I'd been reading about the quad vs. yagi debate (*73 Magazine*, January 1989: "Quads vs. Yagis for Fox Hunting"; by Joe Moell, P.E., KØOV) and had decided to try a quad. I knew that it would work well for radio direction finding, but it wouldn't fit in our car. So, I figured that with a little extra effort, a folding quad would not be too difficult to build.

The folding three-element quad is designed to work well across the entire 2 meter band, and has excellent gain and front-to-back ratio, as well as good side rejection. It is also easily folded, and unfolds in a matter of seconds. Yes, I said seconds. The secret to the folding quad is a notch in the boom which the driven element drops into when unfolded. The driven element is mounted to the boom with a spring-loaded bolt (see Figure 3) which holds it firmly in position. To fold the quad, you simply hold the boom with your hand while pushing up with your thumb. When the support for the driven element clears the notch, you simply fold it up. The elements are connected together with a tie rod which keeps them parallel to one another. In its folded position, the folding quad easily fits into the trunk of the average compact car, which makes it ideal for fox hunting. You should have no trouble building this antenna in just a few evenings, for less than $20.

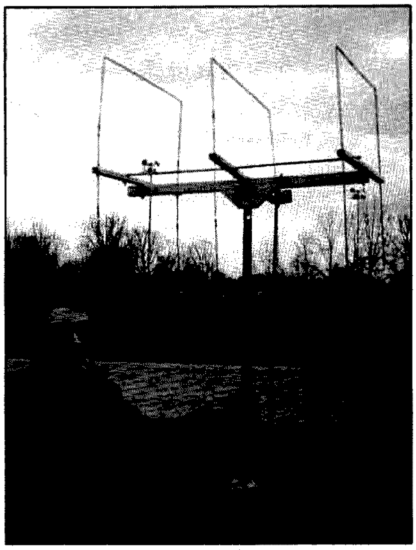


Photo A. Pam N8IAK shows her pleasure with the folding quad.

Using the dimensions shown in Figures 1 and 2, I cut all the supports and the boom from a piece of construction-grade southern pine. The notch in the boom is very important. When not folded, the support for the driven element rests in this notch. I recommend cutting the support for the driven element, and finishing it, first. Then, using it as a cutting guide, make the notch in the boom. The fit should be as close as possible, without being too tight when the quad is unfolded. After the pieces are cut and drilled, sand them smooth and finish them with at least two coats of varnish.

The elements are made of 1/8" brazing rod. It is readily available, rigid, and easily bent—with the help of a propane torch. I used eight 36" lengths to complete this project (if brazing rod is too expensive or hard to find, try 12-gauge aluminum ground wire. It's cheaper and easier to work with, but not as rigid). To bend the brazing rod, clamp it into a vise, heat it until it's almost red hot (a propane torch will do fine), and bend it v-e-r-y gently. Take your time, practice on some scrap rod first, and remember: measure twice, bend once.

Refer to Figure 2 for the dimensions of each element. I found it easiest to make my first bend before inserting the rod through the hole in the support. Since it takes a little more than two rods for each element, you'll need a union to join the rods to one another. I use a union that I made from some small-diameter copper tubing that I bought at my local auto parts store. With pipe cutters, I cut off a piece about an inch long and drilled it large enough to accept the brazing rod. To

Continued on page 50

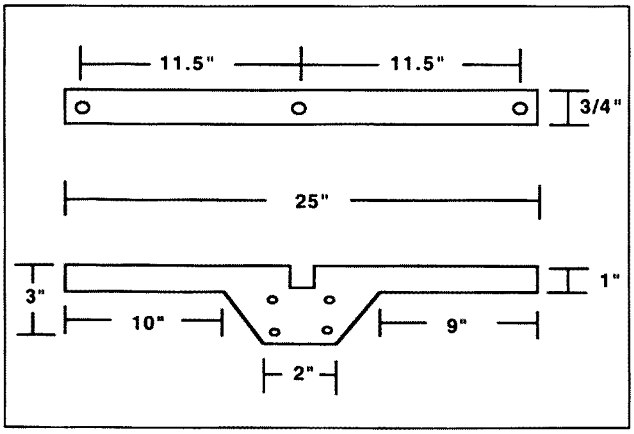
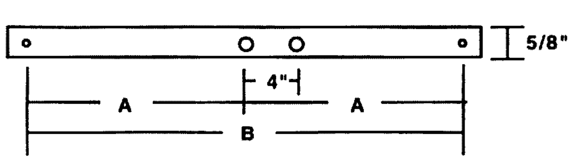


Figure 1. The boom: Cut and drill as shown.



	A	B
Reflector	10-7/8"	21-3/4"
Driven element	10-5/16"	20-5/8"
Director	9-13/16"	19-5/8"

Make each support about 1 inch longer than the B measurement. Make the holes large enough that the brazing rod fits snugly, and can be pushed through with just a little effort.

Figure 2. Dimension table for the quad.

Folding Three-Element 2 meter Quad

Continued from page 46

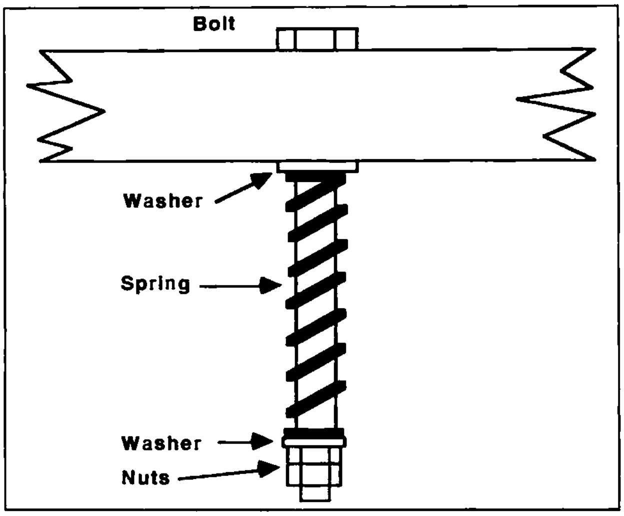


Figure 3. Close-up of the spring loaded bolt which makes up the pivot point of the quad.

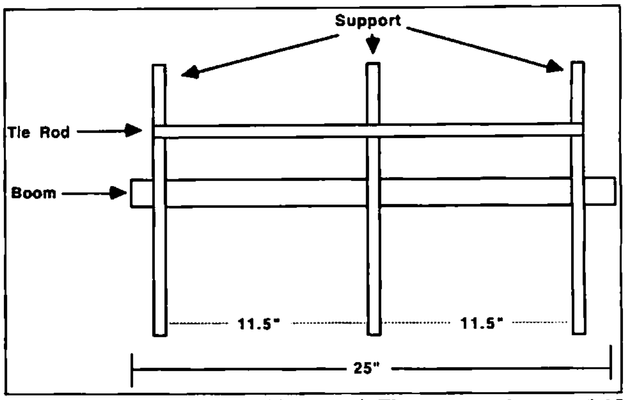


Figure 4. Top view of the folding quad. The spacing shown is 0.15 wavelength.

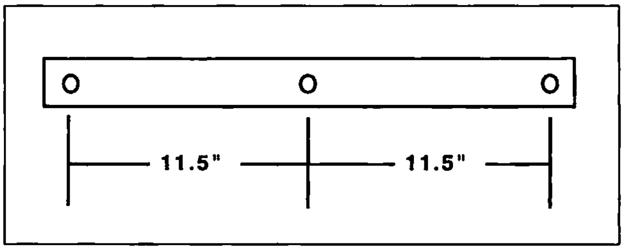


Figure 5. Tie rod—this is made from a thin piece of wood. The only dimension that is important is the one listed. Its purpose is to tie the elements together, and keep them in alignment, while folded and unfolded.

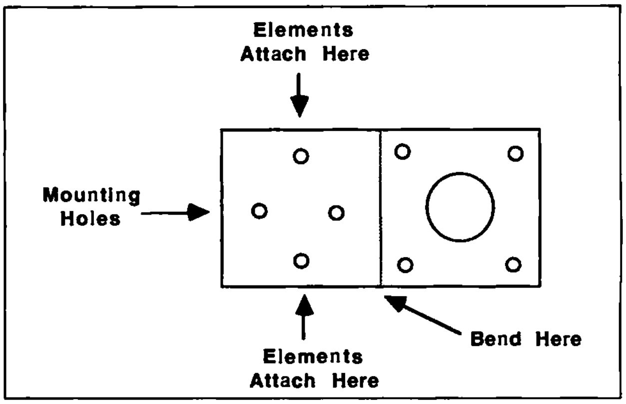


Figure 6. Feed-point bracket. Mount SO-239 on the right side. Mount to the face of the bracket, using 6-32" x 3/8" bolts, attached from behind. Run jumpers from SO-239 to the elements (see text).

join the rods, shine up the ends with steel wool. Insert the rods into the ends of the union and solder them in place. You can use a torch for this, but I've had better results with a high-wattage soldering gun.

The construction of the driven element is just a little different from the others. First, remember not to close the loop on the driven element. Leave it open at the feed-point bracket. The feed-point bracket is pretty simple. I took a piece of scrap plastic (1.5" x 4" x 3/16" thick), warmed it until it was pliable, and bent it at a 90-degree angle. Then I drilled as shown in Figure 5, mounted the SO-239, and mounted the assembly to the support, using screws. The driven element is attached to the feed-point bracket with nuts and bolts. I soldered electrical crimp-type ring connectors to the ends of the elements to make a cleaner connection. Another way would be to bend ends into a loop big enough to insert a bolt through.

Insert the bolt through the center of the support, and, using a bit of RTV compound, or epoxy, glue the bolt to the support.

Now that the elements are finished, it's time to assemble the quad. First, using Figure 4 as a guide, attach the elements to the boom, paying special attention to the spring and washer placement on the driven element. Next, attach the tie rod. This should complete the mechanical assembly of the folding quad. After the matching is done, and you're satisfied with the operation, apply a bit of RTV to the end of all the bolts to keep the nuts from coming undone.

I had very little trouble matching the quad. I took all my measurements outdoors, using an HT and a VHF SWR meter. To match the quad, I simply varied the length of the jumper wires between the ends of the driven element and the SO-239 connector. Once matched, the SWR was acceptable across the whole band. I found that a difference of only a half inch can be significant. The trick that worked best for me was to make the jumper about 4" long, then attach one end to the SO-239 and an alligator clip to the other end. I then attached the alligator clip to the element and, using trial and error, slid the clip back and forth along the element until I found the perfect match. When you find this point, measure the length of the element between the clip and the point where the element attaches to the feed-point bracket. Subtract this from the length of your jumper wire. The result will give you the length of your jumper wire between the mounting bracket and the SO-239.

All done? Great! Now, insert the U-bolts through the boom, then insert the mast. Now you're ready for the next fox hunt.

Field tests were encouraging, and wherever I go the folding quad generates a lot of questions. So far the quad has been used in enough hunts to tell me that I probably won't go back to a yagi anytime soon. ■

Parts List

1	2' x 4' x 8' pine stud
8	36" brazing rods
1	foot copper tubing (see text)
2	U bolts
1	broom handle (mast)
1	1.5" x 4" piece of plastic for the feed point
1	SO-239 (Radio Shack part #278-199)
2	10-24 x 2.5" screws
3	10-24 x 1.25" screws
1	1/4 x 4-1/2" screw
6	6-32 x 3/8" screws
2	4 x 1/2" wood screws
5	#10 washers
2	1/4" washers
5	10-24 nuts
2	1/4 x 20 nuts
1	spring (available at your local home center)
2	6-32 nuts
5	Ring terminals

Number 10 on your Feedback card

73 Review

by Steve Katz WB2WIK/6

Kenwood Communications Corporation
Amateur Radio Products Group
2201 E. Dominguez Street
Long Beach, CA 90801-5745
Telephone:(310) 639-4200
Price Class: $399

The Kenwood TH-28A

2 meter hand-held transceiver.

Kenwood has done it again by producing a tiny, lightweight and affordable VHF handheld that seems to do everything well. The TH-28A is a 5-1/8" x 2-1/8" x 1-3/8" (H x W x D) do-everything handie-talkie that weighs in at only 12 ounces, including its PB-13 standard nickel-cadmium battery pack. It contains some interesting features not previously available in "mini" HTs.

For example, in addition to covering the 2 meter amateur band (144-148 MHz) with 2 watts of transmitter power (using the normally-supplied 7.2V, 700 mAH battery pack), the TH-28A also receives the public service VHF band (136.000 to 173.995 MHz) FM as well as the VHF aviation band (118.000 to 136.000 MHz) AM, and is capable of storing these frequencies in memory or scanning through them, just like a high-priced "scanner." In addition, it contains a "subband" receiver which tunes 438.000 to 449.995 MHz, thus covering the entire 70 cm amateur FM subband (for reception only).

Unlike many earlier-generation HTs, the TH-28A can be charged during operation, as plugging in a battery-charging source does *not* disable the little rig. And it can be operated *directly* from a 13.8 VDC power source, including the optional PB-14 battery pack, or your automobile's cigar lighter, or a base-station power supply; and if operated at this higher voltage, the tiny radio produces 5 watts power output!

Other interesting features include:

•40 programmable memories, easily programmed with very user-friendly instructions. Once you've done it the first time, you *won't* have to refer to the instruction manual again!

•A well-written 63-page instruction manual to get you going.

•Built-in DTMF tone pad *and* CTCSS "PL" tones (39 CTCSS tones total) are standard.

•CTCSS ("PL") tones as well as TX/RX frequency offsets are all stored in each memory for quick and convenient QSY.

•The transmitter can operate at any of *four* power levels, from full power down to 20 mW for line-of-sight work and extended battery life.

•DTMF memories (10 total, storing 15 digits each) allow full "autodial" operation for telephone patching.

•Programmable TX delay time to prevent TX unkeying during autopatch or control system dialing.

•Dual-tone squelch system is standard in U.S. models, allowing DTSS "paging" with prearranged signals.

•DTMF (touch-tone) paging is also designed into the TH-28A, allowing programmable paging codes to identify the calling party.

•Built-in 24-hour clock, accessible anytime you wish by pressing F+9 on the front-panel keypad.

•To supplement the clock function, it also has a built-in electronic timer and alarm—you can literally use the HT as an alarm clock if you wish!

•Crossband operation, transmitting on 144-147.995 MHz while receiving on 438-449.995 MHz, is possible by pressing the F+BAND keys.

•A large (3/16" alphanumeric) display which indicates RX frequency on receive and TX frequency on transmit, including a full-sized "5" digit, with back illumination available by depressing the "LAMP" button, is easy to read day or night.

•In the VFO mode, any frequency within its coverage range may be programmed directly using the front panel keypad. (For example, to dial up "146.520" MHz, you'd simply push the "VFO" button, followed by 4-6-5-2-0 and you're there!)

•Battery voltage is monitored and displayed every time you transmit, so charge state can be determined in advance of the unit "running out of gas."

•With its Battery Saver function on (this is a default), battery life is incredibly long: The standard PB-13 seems to last more than 24 hours (RX only) or eight hours of TX/RX in the "low" power mode (500 mW output) with 50% duty cycle; it lasts about five hours in "high" power (2 watts output) with 50% duty cycle. This is long enough for almost anybody. The rig gives you sufficient warning that the battery is running down so you can switch to a charged spare.

That's Not All

Sound like enough features? There's more. The TH-28A's "on/off" power switch is *electronic*, and is a recessed press-switch which is not easily depressed accidentally; but even if it were momentarily depressed, this would not turn the unit on, as the button must be depressed for more than one full second before it functions. This is a good feature—it saves the battery pack from inadvertent turn-ons. You can switch memory channels (in the "MR" memory mode) or VFO channels (in the "VFO" mode) using either the front-panel keypad or a continuously rotatable switch mounted atop the unit. If you need to hear a station too weak to break the TH-28A's squelch setting, or one lacking the proper CTCSS tone if your unit is set in the PL RX mode, rather than ad-

justing the squelch or reprogramming the rig you may simply press the "MONI" button, which immediately breaks the receiver squelch and lets anything on frequency come pouring right through. Nice!

The TH-28A's 16-digit front-panel keypad may be a bit small, but the buttons are clearly labeled, and spaced adequately for my blundering touch. Possibly a man with really huge hands would have some difficulty, but he'd be the exception. The most-used controls, like "POWER," "MR," "VFO" and "VOL," are quite large and easy to handle for just about anyone.

The rig's frequency steps are programmable from 5 to 25 kHz/step. Every single memory (00-39, a total of 40 are standard) is capable of storing every piece of information that could possibly be needed, and *all* will accommodate "odd splits" (i.e., TX/RX frequency offsets that are not standard). Even some higher-priced, much larger mobile rigs can't do that. Also, the ME-1 memory expansion option will fit the TH-28A to add *200* more memory channels to the unit, for a whopping *240 memories*. I can't think of anyone who could possibly fill all those up with anything useful, but it might be fun to try.

If you'd prefer to display information other than the memory channel frequencies, the TH-28A is capable of displaying anything up to six characters long for each memory channel. These notations can include the numerals 0-9 as well as the letters A-Z. So, if you'd rather remember your favorite local repeater as "BOZO" instead of 147.885 MHz, the rig can be programmed to display the name instead of the frequency. This function is addressed by one of the many "power up" commands; in this case, it's MR + POWER that selects the alphanumeric menu.

> ***"The TH-28A's 16-digit front-panel keypad may be a bit small, but the buttons are clearly labeled, and spaced adequately for my blundering touch."***

The TH-28A's scanning functions can be either time-operated or carrier-operated, and it's capable of scanning memories: memories excluding "locked out" ones; an entire band; a portion of an entire band; a 1 MHz range of your choice; a combination of the VFO and the last-used memory channel; a combination of the VFO and the CALL channel (more on this later); VFO + last memory used + CALL channel; and it's capable of scanning either "up" or "down" the band, with reversal of the direction driven by a single click of the tuning control. Whew!

The CALL channel, which would normally be your favorite one, is programmed using the M + CALL keys, and then recalled with a single touch of the CALL key thereafter. This allows you "instant QSY" to the CALL channel in memory, any time you wish, by pressing a single, large, front-panel key.

The unit's TX frequency offset is programmed per the ARRL Band Plan for 2 meters, and this is the normal default. However, the preprogrammed offset can be overridden with another "power up" function, in this case CALL + POWER. Any offset from 0 to 99.9 MHz in 100 kHz increments may be selected manually and retained in memory for continuous use if you wish.

As with most modern handie-talkies, the TH-28A comes equipped with a "LOCK" function (in this case, a slide switch) which turns off all controls except LAMP, MONI and PTT to prevent inadvertent reprogramming or QSY. It also comes standard with an AC-powered "wall charger" (15 hours to fully recharge a depleted battery pack), a belt clip (removable), carrying strap, flexible "rubber duckie" antenna, and a standard nickel-cadmium rechargeable battery pack.

The antenna connector is a standard BNC receptacle (thank goodness—no weirdo plugs required), and even with the flexible antenna installed the overall height of the TH-28A comes to nine inches: Still a "pocket rocket" to be sure. Optional accessories available (but not normally supplied with the radio) include: a speaker mike SMC-33 which features remote programming functions; the memory expansion unit ME-1 discussed earlier; a battery case BT-8 to hold alkaline batteries; a 12 volt nickel-cadmium battery pack, PB-14, rated at 300 mAH, which allows 5 watt operation (but not for long!); a clip microphone with earphone, EMC-1; a full-blown headset with VOX or PTT for transmit control, Model HMC-2; a base-stand rapid charger BC-15, which will recharge the NiCd battery packs in only one hour; a water-resistant bag WR-2 to allow operation in the swamps(!); a choice of soft cases, SC-33 for the PB-13 standard battery pack or SC-34 to accommodate the taller PB-14 pack; a filtered cigar lighter plug and cable, PG-3F; a fused power cord and connector for use with external 7.2 to 13.8 VDC power supplies, Model PG-2W; and even a "swivel mount" for using the talkie as a mobile rig, Model BH-6. Good grief—no end of accessories for this little unit.

Performance

OK, OK already—how does the darned thing *work?* Like a charm! Its tiny speaker produces room-filling volume, although lack-

Table 1. Performance Measurements vs. Specifications

Kenwood TH-28A 2 Meter Hand-Held Transceiver

Transmitter

Output power with standard PB-13 7.2 v 700 mAH battery pack:

Specified	High	2W	Measured	2.6W
	Med	N/A		2.1W
	Low	0.5W		0.45W
	EL	0.02W		0.02W

Receiver

Sensitivity:

Specified	Less than 0.1 µV squelch threshold	0.2 µV @ 146.000 MHz
	Less than 0.18 µV for 12 dB SINAD	0.3 µV @ 146.000 MHz

Other characteristics are unspecified, but we measured as follows:

20 dB quieting sensitivity	0.35 µV @ 146.000 MHz
	0.35 µV @ 138.000 MHz
	1.05 µV @ 173.995 MHz
"DFQ" sensitivity (no discernible noise)	3.00 µV @ 146.000 MHz
	3.25 µV @ 138.000 MHz
	8.75 µV @ 173.995 MHz
Aircraft band performance: AM mode	
12 dB SINAD	1.80 µV @ 118.000 MHz
	0.45 µV @ 136.000 MHz
Subband band performance: 438-450 MHz FM	
12 dB SINAD	1.05 µV @ 438.000 MHz
	1.20 µV @ 449.995 MHz

Receiver limiting: Excellent. 50% AM modulation at 400 Hz modulation rate produces zero discernible demodulation, even down to squelch threshold.

Adjacent channel rejection:

For 1 dB desensitization	48 dB @ 15 kHz, 146.015 MHz
Out-of-band desense	114 dB @ 10 MHz, 156.000 MHz

Notation: TH-28A RX "S" meter is a seven-segment LCD bargraph; segments 1, 2 and 3 illuminate individually, but then segments four and five illuminate together, and segments six and seven illuminate together. Thus, the "seven-unit display" really only displays five increments or incremental changes.

General

Frequency accuracy: Unspecified. Measured to be +800 Hz @ 146.000 MHz. The "offset" is precise; thus any offset frequency is also +800 Hz. This is bound to vary a bit from unit to unit and will be affected by ambient temperature and age of the unit.

ing great fidelity (an external speaker is a must for serious mobile work), and its internal microphone brings on reports of "wonderful" and natural-sounding modulation from nearly everyone contacted. Once programmed with active, local channels, the little radio is a real pleasure to use. I keep one memory programmed for the local NOAA weather station on 162.550 MHz (available in most parts of the country) and get my WX reports even before the local news stations. Around here, they even report local surfing conditions, real handy for those so inclined. I use another memory set to a CHP (highway patrol) frequency to listen for reports of traffic accidents and routes best avoided until they're cleaned up. (Note: In some states it is a violation of local laws to have a receiver capable of monitoring police frequencies in your car. These "scanner laws" are thankfully being abolished in some states that had them for years, but check to see if it's OK to use a scanning receiver in your area. If it's not and you're caught using one, the rig might be confiscated! Unbelievable, but it's happened.)

Most modern transceivers for VHF-FM (handhelds and mobiles alike) are highly sensitive, but not terribly selective against adjacent-channel or out-of-band interference. This is especially true of those rigs which have wide-coverage receivers that tune beyond the ham-band limits, like the TH-28A. This usually doesn't present a problem when the "talkie" is used with a less-than-zero gain "rubber duckie" antenna, as received signals will never be all that strong, but it can be a pain when such receivers are used with gain antenna systems on the car or at home. As such, I thought it would be important to make some bench tests on the TH-28A to determine just how much rejection it offers to adjacent channels, distant channels, and out-of-band signals. This data is reported, along with other measurements I made, in Table 1.

All Things Considered

It should be noted, and I've written this many times, that portable hand-held transceivers were intended to be used that way, and not as permanent mobile or base stations. It is impossible to squeeze full-scale performance into a 15-cubic-inch radio, especially considering that 4-1/2 cubic inches of that radio are consumed by the battery pack, and another 3-1/2 cubic inches are consumed by packaging (case and knobs). This leaves exactly 7 cubic inches for all the radio circuitry! To put this in perspective, a pack of cigarettes has about the same volume (7 cubic inches). Consider that the HT's electronic "works" must all fit completely inside a pack of regular (not extra long, or "100 mm") cigarettes. This includes the frequency synthesizer; memory module; all receiver preamp, mixer and discriminator functions; all transmitter buffer, multiplier, driver and final amplifiers and heat sink; a powerful audio amplifier, speaker and microphone; interconnections; T/R switching; I/O ports; and controls. It's quite a lot to jam into a pack of cigarettes, and doesn't leave much room for such frills as narrowband helical resonators in the receiver front end, multipole crystal filters in the receiver IF, multiple receive conversion stages with "up conversion" to help reduce spurious responses and images, and so forth.

> ***"... it's hard to beat a "handie" for portable/field work, hikes in the woods, camping, biking, skiing, boating and similar temporary exercises, or carrying around at the local swap meet.***

The TH-28A, like most small HTs, gets quite warm during extended transmission periods, running at its normal power level of 2 watts output. It gets bloody uncomfortable when running 5 watts output, and makes me wonder how long it can really last at this power level without failure. HTs were not designed to support long "ragchews," with stations transmitting for 10 minutes at a time, nor were they designed to replace dedicated mobile units. If your primary use for a 2 meter rig is mobile operation, then by all means buy a mobile rig. If you want a base station rig for permanent home use, there are plenty on the market to choose from (base rigs are identifiable by their built-in AC power supplies). But it's hard to beat a "handie" for portable/field work, hikes in the woods, camping, biking, skiing, boating and similar temporary exercises, or carrying around at the local swap meet. And they make good temporary mobile rigs in a pinch. (I use an HT in rental cars when I travel out of town. With 2 watts and a "mag-mount" antenna, it's amazing what can be worked.) But just as magnetic-mount antennas are intended for *temporary* installations, so are handie-talkies. You cannot expect mobile rig or base station performance from a 12-ounce transceiver! If you do, you're bound to be disappointed.

In all, I love the TH-28A. No, it's not perfect. I wish it had fewer high-tech features and more old-fashioned RF performance; but then, I wish the same of every HT I've used. I'd gladly trade 240 memories for some front-end filtering, and I'd be willing to accept a portable that's 25% larger in trade for a triple-conversion receiver with a 16-pole IF filter. But Kenwood knows what they're doing and enjoys a huge worldwide market success. They're appealing to the largest cross section of users, and the TH-28A has a *lot* of appeal. Not only that, but even my XYL (not a ham, not even close) thinks it's "cute." Can't ask for much more than that.

Choosing a Handheld

If you're in the market for a handhheld, consider these factors:

• All the modern "talkies" have good transmitters, ranging in output power from 1-1/2 watts to about 7 watts. They sound good on the air. Power output has more to do with battery power available than any other factor, and most HTs will vary in output depending on the battery pack used. In general, the lower voltage but higher current packs will last much longer between charges than the higher voltage, lower current packs will. The difference between 2 watts and 5 watts output is almost inconsequential, so I'd almost always recommend running lower power and using the highest-capacity (ampere-hour rating) pack available. The TH-28A comes standard with the PB-13 pack, rated at 700 mAH, and is an excellent compromise between output power and operating life.

• The primary differences among the various HTs on the market can be found in their receiver performance, features, "standard" accessories, frequency coverage, and ruggedness and reliability. The TH-28A's receive performance is very good, but the "talkies" that cover only the 2 meter ham band and have no extended range (frequency) coverage can be a bit better, since they are more optimized for the 4 MHz they cover. Unfortunately, this trade-off is technology-driven and we can't do much about it without greatly increasing size, weight and price of the equipment.

• I may be crazy, but to test the ruggedness of the TH-28A I put it through a short series of environmental stress tests (which may void the warranty, so I don't recommend you do the same). I have access to mechanical shock and vibration testers, and also 85/85 environmental stress chambers (i.e., 85% relative humidity at 85 degrees C ambient temperature), at my work location. I subjected the TH-28A to shock and vibration as follows: 50g mechanical shock in all three axes with a 10 mS shock pulse width; 50g vibration with rotating polarity; and 85/85 RH/temp testing for 24 hours. The HT worked OK after such stress testing, which is quite severe for consumer electronic equipment, but I had to let it cool down and dry off after the 85/85 test because it wouldn't power up at first. The TH-28A is a rugged piece of gear indeed!

73 Review

by Robin Rumbolt WA4TEM

The XPERTEK DVMS/1+

XPERTEK Electronics
P.O. Box 768
Lockport NY 14095
716-434-3008
Price Class: $349

Digital voice mail system for repeaters.

Adding real voice ID messages, voice mail, bulletins, and sound effects to repeaters has been possible for several years now by using circuits and modules that digitize voice and store it in RAM. The only problem has been that either massive amounts of RAM were required, or the message length had to be kept short. Well, the folks at XPERTEK Electronics have changed all that with the new DVMS/1+ Digital Voice Mail System for repeaters.

This system stores digitized voice information on a computer's hard disk at a sysop-selectable rate, thus allowing a tremendous amount of recording time, limited only by the size of your hard disk. A hard drive with 20 meg of free space can hold more than 30 minutes of messages (that's minutes, not seconds!), which is more than enough to hold *Westlink* or a bunch of ID messages. With hard drive capacities now in the gigabyte range, it's hard to imagine not having enough room for all the ID messages anyone would ever want.

Features include time and date voice readout, user-to-user voice mail, a general bulletin announcement system, a DTMF checker, a scheduler, a BBS system, and a signal check feature which lets users hear a short playback of their last transmission. Also provided are rotating ID capabilities and an access-codeless autopatch dialing system.

In addition, the DVMS/1+ can interface with the popular RC series controllers from ACC, allowing the repeater controller to trigger various messages and respond to various commands from the voice mail system.

The Hardware

The XPERTEK system is composed of an interface card kit, a few connectors and cables, software on 11 floppy disks, and a manual. It is not a complete system in itself. The user must supply the following:

1. IBM-compatible computer (80286 CPU or higher is recommended) with at least a 20 meg hard drive, 640K of RAM, an onboard real-time clock, and a 360K floppy drive. A serial port is required to interface with ACC controllers. A modem is needed as well if the BBS features of the DVMS/1+ are to be used.
2. A Soundblaster (trademark of Creative Labs, Inc.) 8-bit audio I/O card.

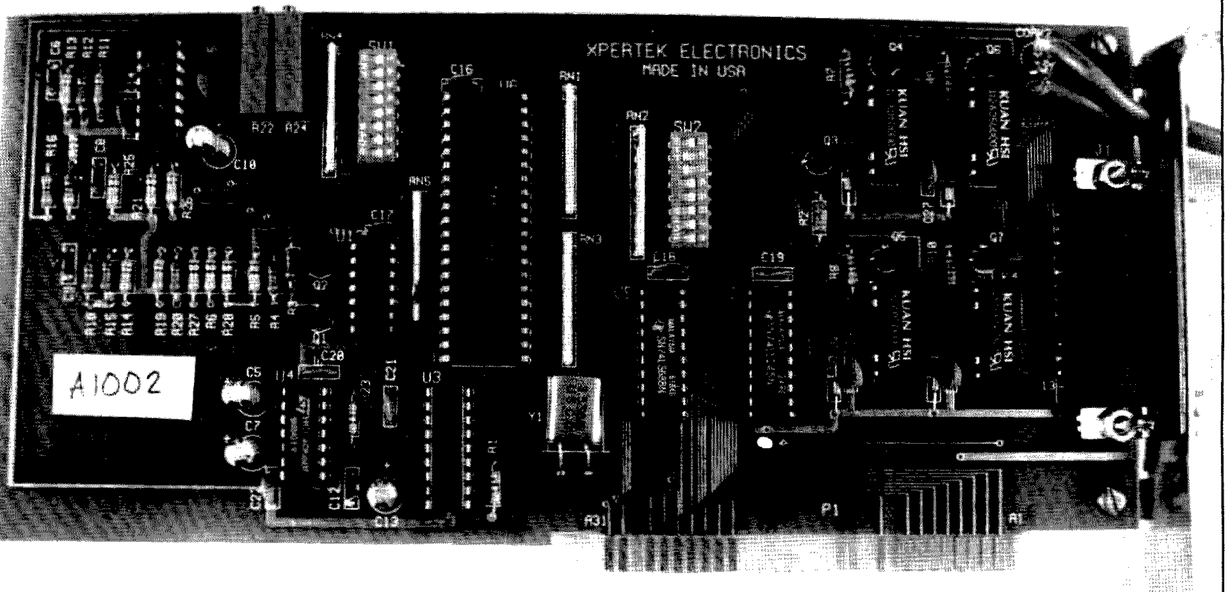
The DVMS/1+ board serves as the interface between the PC and the repeater system. It has an on-board DTMF decoder, a multiport interface to the PC bus, four relays for various output functions, and some op amps and transfer gates for audio I/O interface.

Although this is a kit, a complete schematic is not provided; only a partial schematic of the audio input stage is included in the manual. I found this to be such a great shortcoming during installation that I invested the time to trace out the schematic myself. XPERTEK would not provide a schematic.

Construction and Installation

Construction of the board is straightforward. The board is well-made and silk-screened. The manual provides guidance on which parts to install in which order. It took me only a couple of hours to complete the board, and it worked the first time.

Installation was a bit more difficult. It took a few trips to the repeater site and several calls to XPERTEK to get it right. Taking advantage of all the features of the DVMS/1+ requires making audio and logic connections to inputs and outputs of our RC-850 controller, connections to the main and control receivers and the



The XPERTEK DVSM/1+ digital voice mail system.

transmitter, and connections to the Soundblaster board and the computer's serial I/O card.

The DVMS/1+ manual attempts to tell you what each I/O pin connects to, but some of the descriptions are ambiguous, not really telling if the pin is an input or output. It was here that my traced-out schematic was invaluable. I even found some non-fatal design errors on the PC board which XPERTEK said would be corrected in its next generation of boards.

Software installation was quick and painfree. Although there are 11 diskettes full of software to be loaded, the "Install" program makes it quick work. The software takes up about 10 meg of space on the hard drive.

Operation

All operations of the DVMS/1+ are prompted by a pleasant female voice, which I understand belongs to a lady named Kathy from upstate New York. She asks for user numbers and passwords, and even directs you when to talk.

The voice mail system accommodates up to 1,024 users, each with a unique user number and a user-configurable password. User access can be individually enabled and disabled for maximum control. The system works fine, but takes many digits to operate. On our repeater it takes at least eight digits just to turn on the voice mail system. Then the user must enter commands for the functions he wishes to activate.

These lengthy codes are only needed for voice mail and bulletin functions. All other functions are lumped into what is called "Direct Access," meaning that no lengthy access code or password is required. The sysop does have the option, however, to impose password protection on any function.

One really nice sysop feature of this system is the ability to make the access and command codes anything the sysop wants them to be. There are no preprogrammed prefixes that are cast in concrete. The system comes with default codes for everything, but they are easily changed. That's really nice.

The general announcement system is available to all users so that anyone can post an announcement for all to hear.

The DTMF checker and time and date functions are standard fare on repeater controllers nowadays, but it's really nice when the voice gives you the day of the week and the name of the month as well. There are several options available to customize these readouts.

A feature that has proven most popular on our repeater is the signal check feature. This allows users to replay a few seconds of their last transmission to hear the quality of their signal into the repeater.

The scheduler makes it possible for the system to send control codes to itself and to the repeater controller at preset times. It adds capabilities not available on the RC-850 scheduler. We can even use it to dial the telephone automatically and download data.

The BBS system allows limited control of the PC via modem, including reading directories and file manipulations. All functions of the DVMS system can be accessed via the modem. Messages and files can be uploaded via modem to avoid squelch tails and radio noise. You can even send commands to your repeater controller via modem and the DVMS/1+ system.

The access-codeless autopatch dialer system enables the sysop to build a file of permitted telephone prefixes. Then when a user wants to make a call, he simply dials the phone number desired. The DVMS/1+ checks the prefix. If acceptable, it sends the correct autopatch "ON" code and telephone number to the repeater controller, commencing the call.

This system was harder to install than necessary due to difficulty with the manual and the initial lack of a schematic.

We experienced some crosstalk problems due to running various audio signals through the same multiconductor cable supplied with the kit, but this was easily solved by running separate cables.

When the computer first boots up, the DVMS/1+ holds the transmitter on the air until its hardware initialization program is successfully run. If it doesn't run successfully, your transmitter is locked on the air!

The DTMF decoder on board the DVMS/1+ has different characteristics from the decoders in our RC-850, even when fed from the same audio source. Consequently, we had to do some audio level and frequency response tailoring to get it to decode as well as the RC-850.

This system will work with an old XT computer (80286 and above is recommended), but

it will be too slow to be useful. We recently upgraded trom a 286 12 MHz system which exhibited short (less than one second) delays, to a 33 MHz 386 SX system. Changing the motherboard did not make that big a difference. *However*, changing from a 20 meg 65 ms hard disk to a 50 meg 20 ms hard disk made a tremendous difference. Responses are now instantaneous.

Do not add this system to your repeater unless you have a way to remotely control power to the PC! This is an absolute must!

Although a watchdog timer pulse train has been provided in the most recent software upgrade, implementation of the watchdog timer hardware is still left to the user. A future hardware release will no doubt incorporate a watchdog timer circuit, but at this time it is not available.

XPERTEK is a garage-shop operation. Its proprietor, Andy Mill, only wears his XPERTEK hat on nights and weekends. If you call, chances are you'll almost always get his answering machine or his "secretary." Funny, but he doesn't use a voice mail answering system!

On the Plus Side

There have been several software upgrades since we purchased the system which have virtually eliminated all software bugs, and have made some of the features easier to use.

Despite initial misgivings about having a PC at a remote mountaintop site, we have gone through one cold winter, one lightning season, and one very hot summer with few PC-related problems. The only lightning-related PC damage has been to the modem, resulting from a direct hit which severely damaged much of the rest of the equipment. The DVMS/1+ was not affected.

The DVMS/1+ creates a daily date-time stamp log of all DTMF tones it decodes, which is more versatile in some ways than the same RC-850 function. It will store *every* digit it decodes, not just the ones that activate functions, although it does also show which functions have been activated.

> ***"These things have made our repeater the one to listen to in our area. Membership in our repeater club has jumped substantially since the system was added."***

While I mentioned that telephone support was intermittent, I must also say that when you do make contact with Andy Mill, he'll go the extra mile to help work out problems. He has spent a great amount of time on the phone helping to get our system operational.

If you want to customize some of the system's prompting messages, that is easily done, too. We have Jack Nicholson doing some of our prompts now!

Conclusion

The DVMS/1+ affords us the capability of having a great variety of ID messages, sound effects, and humorous one-liners that pop up unexpectedly at the most opportune moments, all without worrying about how much memory is left. We have used the system for meetings, hamfests, and net announcements. Various users have posted "equipment for sale" and "equipment wanted" announcements. Local PC user's group and astronomy club members, who are also hams, have posted their meeting announcements. We occasionally run an announcement inviting non-hams interested in becoming hams to call a certain phone number for information on how to get into amateur radio, and we've received many calls from scanner listeners as a result. We have posted "Elmer" bulletins to help new hams as well. Any repeater club member can post a bulletin *without* control op assistance.

These things have made our repeater the one to listen to in our area. Membership in our repeater club has jumped substantially since the system was added. I believe that soon no advanced repeater will be without such a system—and this one is reasonably priced!

A future software release will allow the scheduler to execute script files, which will allow such things as middle-of-the-night automatic dial up and recording of *Westlink* for user-requested playback at a future time. This software has been under development for some time and may be ready for release by the time this review is published.

After working on and with the DVMS/1+ system for a year now, would I buy it again? In a heartbeat! I can't imagine our repeater without the capabilities this system affords.

RTTY LOOP

Number 12 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Here In Baltimore it's cold, snowing, and not really a nice day to be outside. So, if it's nasty where you are too, why not look at some ol the things you can do over a warm radio? Over the recent past, I have been offering several disks of RTTY programs. Many of you have requested more information on these collections. This month, let's have a look at Disk #4 of the "RTTY Loop" Software Collection.

Before we delve into the programs, a word about shareware, freeware, public domain, and the like. Except for the first term in that list, many such programs are free and in the public domain. This means that you may feel free to use them, or throw them away, or modify them, at your pleasure. Many of the "free" programs carry a copyright notice, which means that you cannot claim authorship or nominally incorporate them Into a work which you then call your own, but at least the price is right.

Shareware is a different story. When you acquire a shareware program by downloading it from a bulletin board, getting it on a disk from a software vendor, or receiving it as part of the "RTTY Loop" Software Collection, you have not bought the program. You have obtained a copy to try out and, if you like it, you are requested to send the author the remuneration requested in the documentation. This honor system, "try before you buy" software, works quite well, and is the preferred system of distribution for many fine amateur radio products.

Ail that aside, there are seven programs in the current edition of Disk #4. They encompass a wide range of RTTY, DX, packet, and AMTOR capabilities. A brief synopsis of each program may help bring this into focus.

DXER13.ZIP

Written by WA6JOO to gain experience in QuickBasic programming, DXer is a versatile amateur radio program primarily of interest to the HF DX operator.

As he puts it, the DXer concentrates several functions of interest to the serious DXer into one (hopefully) easy-to-use program:

•Bearing and distance from transmitter to receiver. Path ends may be selected by latitude-longitude, grid square, prefix, or by browsing through the data base.
•Sunrise and sunset times for any location.
•Maximum usable frequency and frequency of optimum traffic between any two locations.
•A listing of all locations sharing a common terminator line (Gray Line).
•Custom prinitng of bearing/distance charts for any location.
•A grid locator function using either six-digit or four-digit coordinate system.
•A complete data base of all ARRL countries, as well as other locations around the world. The data base shows latitude, longitude, continent and CO zone of each location. Entries may be easily added, deleted or edited.

The program is released for personal use, and a contribution of $10 to the author is requested, if you feel it is of use to you.

FAXFRQ.ZIP

This is an informational file, with lists of HF frequencies of news and WEFAX stations monitored. It was accurate when compiled, but this information is always changing. However, it's a good starting point for monitoring.

PHS300.ZIP

PHS, Version 3.00, Is a host mode server program for the PK-232 written by Peter H. Heinrich HB9CVV. It provides a variety of features, including:

•Support of packet, AMTOR, RTTY, ASCII, Morse and signal modes.
•User configurable com-port, colors and texts.
•Split-screen operatlon.
•Command and parameter entry In mode sensitive dialog windows.
•Extended help functions.
•Review of received text (backscrolling).
•Printing and snapshooting the review-buffer.
•Logging (capturing) to file.
•Online printer support.
•Send text from file.
•Binary file transfer using YAPP protocol (packet mode).
•Multi-channel operation (packet mode).
•Heard list showing the path (packet mode).
•Net/ROM Irames are decoded (packet mode).
•Word-wrapping is available (packet mode).
•Temporary exit to DOS.
•Built-in message edltor.
•Support for screens up to 80•60.
•16550A chip support with FIFO.

The program is free; the author requests only your comments on his work. This is a comprehensive pro-

HAM HELP

Number 13 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate it it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Where can I send to get an "Operational Manual" for my HALLICRAFTERS Model SX99 Receiver? The manual is very important to my operating and maintaining this equipment. *Frank W. Arnold, 1215 Sullivan Ln., #82B, Sparks NV 89431.*

I am looking for info regarding the SBE (Sideband Engineers) Model 33 80-15 meter transceiver; operation and service manuals, mike wiring diagram, and modifications. Thanks! *David Colburn AA1FA. 130 Essex St., S. Hamilton MA 01982. Tel. (508) 468-2199, Ext. 328; or packet @ K1UGM.*

RADIO Lost or Stolen in the US Mail: A 2 meter ICOM Model IC-2SRA Transceiver; Serial #03304. Marked with call K1UXD. A well-marked priority package has not arrived at its intended destination. Reward for return. Thank you. *Paul F. Kelly, 135 East Main St., #V8, Westborough MA 01581-2741 USA. Tel. (508) 898-3202.*

NEEDED: The schematic for a HALLICRAFTERS HT-32 transmitter, about 1958 vintage. I'm anxious to get it back on the air. *Al Smiley K8NOV, 9970 Page Rd., Marlette MI 48453.*

NEEDED: Information on schematics, programming, and re-tuning ol KENWOOD TK-801S down to 440-450 MHz. Also looking for 6m SSB/FM and other VHF/UHF equipment and KENWOOD TR-751A accessories to swap for computer parts and equipment. Thanks. *Rob Bellville N1NTE, P.O. Box 892, Northboro MA 01532.*

I am a newly licensed Technician and am interested in obtaining information about using Repeaters in my area. *Ray Chase N1QFF, Mt. Peg Rd., Woodstock VT 05091. Tel. (802) 457-4084; FAX: (802) 457-4517.*

WANTED: Schematic and/or manual for PRECISION Apparatus Model E-200-C Signal/Marking Generator (copies ok); RCA Receiving Tube Manual (preferably late 60's–70's edition). *Chet Smith WB2LUQ, R.D. #1 Box 30, Verona NY 13478.*

WANTED: Manual or copy of HP1707B HEWLETT PACKARD 75 meg scope. I will pay copying fees ets. *Mike N4BME, (804) 564-8821.*

gram, which has been ported to OS/2 as well, and seems quite capable.

PKTGOLD.ZIP

PktGOLD is another multimode controller for AEA TNCs. This is a test drive of InterFlex Systems Design Corporation's versatile control program. It enables control of packet, RTTY, AMTOR, and other modes of the AEA series of controllers.

The test drive is functional, but it comes with minimal documentation. It is free, and may be circulated at will. Full commercial versions of the program are available from the authors for $79.75 for the Enhanced version, and $59.95 for the Multimode version.

PKTWIN11.ZIP

Written by Paul M. Hounslow, PktWin is a Windows-based controller for packet controllers. The controller is connected through the computer's com port, and modes and features configured via the program.

With many of the switches set in an INI file, this is an economical, versatile program. No payment is requested by the author.

TUWIN.ZIP

Discussed last June, TUWIN was written by Wayne E. Wright W5XD, and designed as an accessory to the WriteLog Windows logging program to allow Windows-based logging and RTTY for contesting, as well as general operations. TUWIN works with old-style RTTY terminal units, like the HD-3030, MFJ-1229, or HAL ST-6, that do not do internal Baudot-to-ASCII conversion. It thus should not be used with multimode controllers like the PK-232 or KAM. With a split-screen display, text to be transmitted is entered into the lower window, received text is displayed in the upper window.

The program uses the DTR and RTS lines on the serial port to indicate "transmit," with the lines being keyed about 500 mSec before the first character is sent, and continuing until about 500 mSec after the last.

> ***"Overall, this is a neat, if bare-bones, approach to using an older terminal unit on RTTY, with a spiffy Windows display."***

Overall, this is a neat, if bare-bones, approach to using an older terminal unit on RTTY, with a spiffy Windows display. Again, this is a freebie!

XPCOM1.ZIP

Gary Johnson KF7XP has his name on XPCOM, a program written to fill a void that has existed in commercial software for digital communications. The user interface has been designed to reduce the overall "learning curve" normally associated with this type of product.

XPCOM was written originally for the MFJ-1278; however, it has also been structured to work with the AEA PK-232. Operation of the PK-232 has been optimized to use AEA's HOST mode.

XPCOM offers the following features to simplify operation for the user:

•Pull-down menus.
•Custom operation with the AEA PK-232 and MFJ-1278.
•Dual-TNC support.
•Mouse compatibility.
•One-key brag file and text operation.
•External interfacing to the user's favorite text editor.
•Offers full packet, AMTOR, FEC, PACTOR, BAUDOT and CW modes.
•Full use of the HOST mode for the AEA-PK232.
•Simplified command structure for the MFJ-1278.
•Multi-connect operation with XP Windows.
•Intuitive on-line help system.
•Quik-connect feature for packet.
•Auto-route capable through brag text.
•Real-time and background printer support.
•Multiple ASCII file transfer in packet mode (AEA only).
•Built-in logging, with AutoSearch.
•Macro support.

XPCOM is classic shareware, with the author requesting that if, after trying the program for no more than 30 days, you choose to use the program, you register it with him for the sum of $39. Still, this is quite a bargain.

So, these are the programs in the "RTTY Loop" Software Collection, Disk #4. If you would like to obtain a list of programs included in these collections, send a self-addressed, stamped envelope to me at the above address, or Email on CompuServe (75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR). The collections themselves may be had by sending a 3.5" high density (1.44 Mb) disk, or equivalent capacity in smaller disks, for each collection; a stamped return mailer; and $2 for each disk to be filled, to the address at the top of this column.

Next month we'll take a look at what some of you have had to say lately. Who knows, if you write today, it just might make it into the column before summer! Stay warm, and see you next month.

Number 14 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Some Miscellanea

Every now and then I like to take a few potshots at those topics that reader mail indicate are of interest to you, but that requires less than a whole column's worth of discussion. This month we will take a look at a couple of circuits that fall into that category. You might find them interesting.

Before going on, however, let me reiterate that my printed circuit boards for the MAR-1 preamplifier are still available for $7. You can get them either from me directly (P.O.Box 1099, Falls Church VA 22041) or from FAR Circuits (18N640 Field Court, Dundee IL 60118). FAR makes boards for most *73* projects. I also have some MAR-1 chips left, which sell for $4.95 each, or alternatively, I'll send you both the MAR-1 and the printed circuit board, plus either 100 pF or 1,000 pF chip capacitors, for a total of $10. I'll keep the offer open while supplies last.

Let's take a quick look at two different circuits: first, an active bridge amplifier for Wheatstone bridges and differential output RF bridges; and second, an audio notch filter.

Bridge Amplifier

Many bridge and other measurement circuits have balanced or differential outputs. That is, the output is not single-ended, which is a voltage measured with respect to ground, but is floating. A differential output has two floating lines, and the output voltage is proportional to the difference between the voltage appearing between each line and ground.

Figure 1 shows a circuit for an output meter that will serve as the output for such a bridge. Amplifier A1 is an operational amplifier connected in the DC differential amplifier configuration. Provided that R1 = R2, and R3 = (R4 + R5), the output of this circuit is:

$$V_O = V2 - V1\left(\frac{R3}{R1}\right)$$

In the specific configuration shown in Figure 1, the gain (R3/R1) is unity (1), so the circuit is relatively insensitive. By increasing R3, R4 and R5 by a factor of 10, you can get a gain of 10, or increase the components by 100 and the gain goes to 100.

A signal output voltage is provided to the "rest of the world" through J1. In most cases, J1 will be an RCA phono jack or a BNC chassis-mounted "RF" style connector. The alternate output is a zero center 100 μA (up to 1 mA can be used) DC microammeter. Potentiometer R6 is a sensitivity control that permits adjusting the deflection of M1 without varying the bridge circuit.

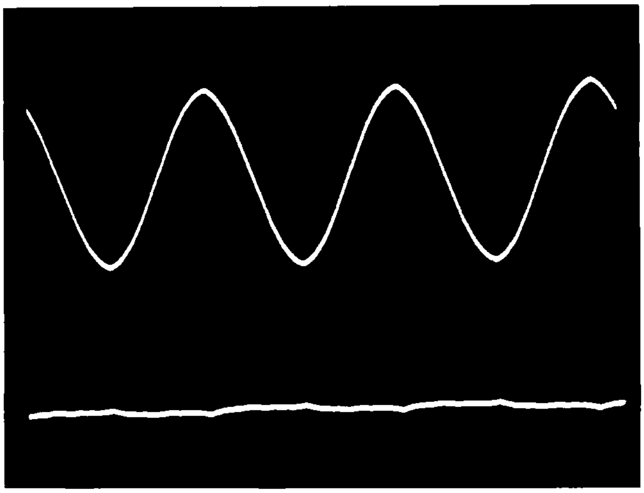


Photo A. Oscilloscope trace showing input and output of the notch filter (49 dB attenuation).

Amplifier A2 is a buffer amplifier to isolate the light emitting diodes, or LEDs (D1 and D2), that serve as a visual output indicator. Two LEDs are selected that have approximately equal output levels. To select, connect both diodes such that each is in series with an 820 or 1,000 ohm resistor. Connect them across a 12 volt DC power supply so that both are illuminated. If both diodes are approximately the same brightness, then use them. Otherwise, swap out one of the diodes with others (LEDs can be bought in bulk) until a match is found.

When connected into the bridge amplifier circuit, D1 and D2 are opposite in polarity. Diode D1 will light up when the output of A2 is positive, and D2 will light up when the output of A2 is negative. When the voltage is zero, neither lamp is lit. As a result of this

feature, the illumination will let you know when the bridge supplying the input signal to A1 is in balance (V2 - V1 = 0), or in which direction it is unbalanced.

I've used this circuit on a number of instruments and found that it works well. The illumination of the LEDs drops off smoothly until a point very close to null is reached. However, don't even think about using it in sunlight. Under outdoor conditions you probably won't see the LEDs when they are fully lit (remember those mid-1970s calculators and digital watches with the LED readouts?).

The active devices are operational amplifiers. I've used 741, 1458, CA-3140 and CA-3240 devices for this circuit. The 1458 and CA-3240 devices are dual op amps, so only one is needed to accommodate both A1 and A2.

The DC power supply connections are not shown, but each device needs V- and V+ DC power supplies (unless a dual op amp is used, in which case only one connection is needed for each V- and V+).

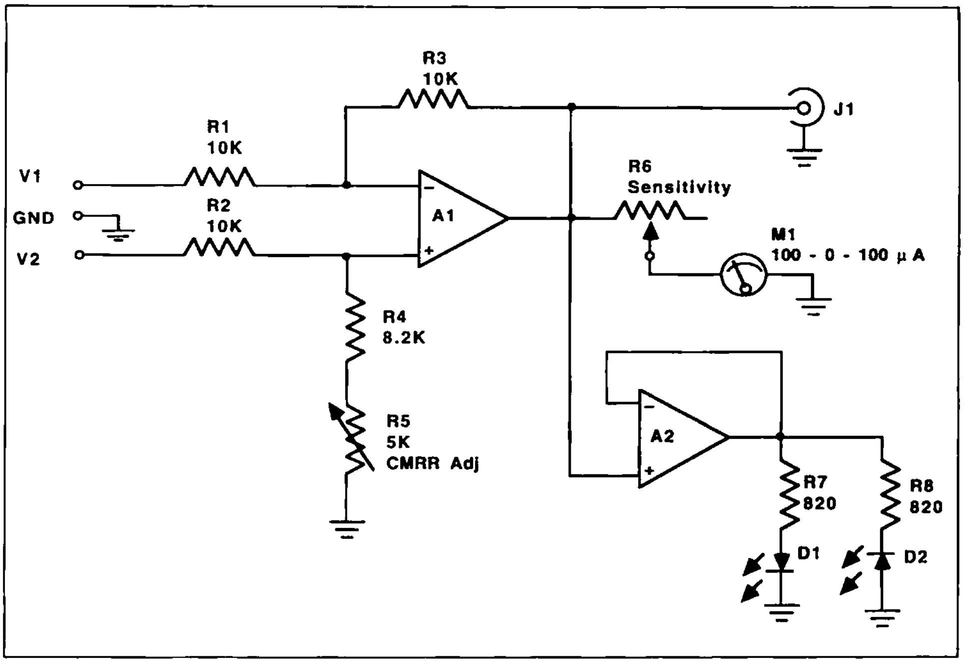


Figure 1. Bridge null voltmeter/amplifier.

Audio Notch Filter

A notch filter is a band reject filter; i.e. it rejects a narrow band of frequencies around the center frequency. Several uses are made of the notch filter. CW buffs sometimes build two types of filters. A high-Q band pass filter will pass only the 400 to 1,200 Hz signal that you desire to copy. A notch filter, on the other hand, will reject the design frequency, so it can be used to eliminate unwanted interfering signals. For example, you might design a bandpass filter to pass, say, 800 Hz (or whatever is comfortable for you), and a notch filter to take out 600 or 1,000 Hz. Interfering signals could then be attenuated even further than the slope of the bandpass filter indicates.

Another use for the notch filter is to reduce the 60 and 120 Hz hum in the output of audio amplifier circuits. You

may find that long leads, noise from the power supply, or other defects cause an unwanted amount of hum in either your transmitter or receiver. I built an active notch filter to eliminate the hum frequently heard in direct conversion receivers that are powered from the AC power mains. The notch filter is placed in the signal line between the output of the detector/mixer of the direct conversion receiver and the input of the audio amplifier.

Figure 2 shows the circuit for a simple notch filter that is tunable. There are other designs, but they require dual potentiometers or dual capacitors to tune them over even a small range of frequencies.

The active devices are operational amplifiers. You can use any op amp that will work at the frequency range you need. For communications purposes (F less than 3,000 Hz), a 741 is sufficient; a 1458 will suffice for both A1 and A2 because it is a dual op amp. For higher frequency ranges use CA-3140 or CA-3240, or any other device with a high gain bandwidth product.

The input and feedback resistors are not too critical, but 250k ohms to 2.2 megoghms are recommended. What is necessary, however, is to make $R1 = R2$ and $R3 = \frac{R1}{2}$.

The notch frequency is found from:

$$F_O = \frac{1}{2\pi\sqrt{RaRbCaCb}}$$

For a 60 Hz notch filter, good values to start with are 124k ohm for Ra and Rb, 1,500 pF variable for Ca and 1 µF for Cb. Scale these values downwards for higher frequencies, using the above equation as a guide.

Photo A shows an oscilloscope presentation of the input and output signal from the filter at resonance (i.e. when the input frequency is at the notch frequency). In the filter used for this test I used the 60 Hz version and the values described above. The input signal (upper trace) was a 1 volt p-p, 60 Hz signal from my function generator, while the output signal (lower trace) was barely visible at the same scale on the oscilloscope vertical input. When the vertical input was expanded, it was shown that the notch filter produced an attenuation of 49 dB at the notch frequency, plus or minus the measurement error of my equipment.

NiCd Battery Charging from DC Power Supplies

A reader wrote to me and asked if it is possible to charge hand-held transceiver nickel-cadmium batteries from +6 or +12 volt DC bench power supplies. The answer is an unequivocal yes and no. If the DC power supply has a current limiter control as well as a voltage output control, then yes; if not, then no . . . don't try it without special knowledge. The procedure is simple:

1. With the current limiter all the way on (zero output current), and the voltage set to about a third of the battery terminal voltage, short-circuit the output of the supply and then slowly increase the current to a level that is 1/10 of the ampere-hour rating of the NiCd battery; i.e. if you use 500 mAH batteries, then set the short-circuit output current of the supply to 50 mA.

2. Remove the short circuit, and increase the voltage output of the DC power supply to the exact potential of a fully charged battery (see instructions for the particular battery pack).

3. Connect the battery to the supply, being careful to observe polarity. Charge at 1/10 level for 14 hours.

The battery can blow up if charged too rapidly, or if too high a voltage is used. That's why the current limiter and output voltage adjust controls are needed. I prefer to place the battery in a small wooden box to prevent "shrapnel" in case the battery does blow up. Good luck and work safe.

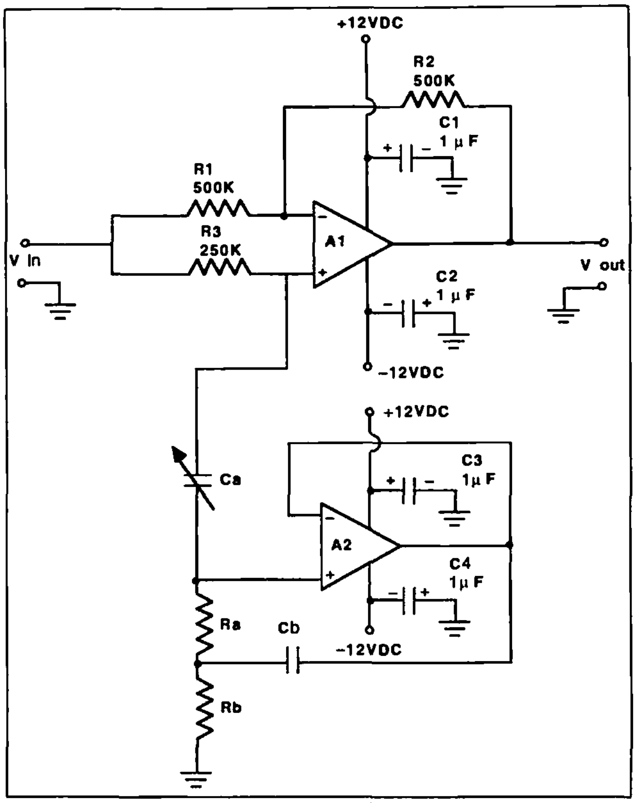


Figure 2. Audio notch filter circuit.

HOMING IN

Number 15 on your Feedback card

Radio Direction Finding

Joe Moell P.E. KØOV
P.O. Box 2508
Fullerton CA 92633

Texas T-Hunters Trap Teen Thief

"Every ham needs a basic understanding of the principles of transmitter hunting." That's what I tell ham clubs and convention forums in my talks on radio direction finding (RDF). Of course I hope that when I'm finished, everyone in the audience will want to try friendly RDF competitions (usually called foxhunts or T-hunts). These events add to the camaraderie of our hobby while teaching useful propagation and electronics skills.

But even if you never set out to find a radio fox, you will probably find RDF techniques useful in your future ham experiences. Perhaps you'll want to join a chase team for a high altitude ham balloon launch, or find an annoying source of interference, such as a noisy thermostat or cable TV leakage.

Dallas DF Detectives

When someone's transceiver is stolen or there is a stuck carrier on your local repeater input, you'll be ahead of the game if you have already assembled and installed some mobile RDF gear. You will be even better off if you have accumulated some T-hunt experience. Tom Lewis AB5CK proved this a few months ago when he used his RDF skills to foil a young radio thief.

AB5CK regularly goes T-hunting in the Dallas/Fort Worth area. "My friend Randy Harlin AA5WJ teaches music at a middle school," says Tom. "He is also the owner and operator of a 2 meter repeater, which he likes to monitor with a dual-band handheld at work. One day the HT was stolen off his desktop. The taker apparently had little knowledge of ham radio and was unaware of how to change frequencies. Before long, there was a rash of profanity over Randy's repeater. He called me that evening.

"We speculated that the unlicensed profane operator was the student/thief," Tom continued, "and we guessed that he might make additional transmissions the following day after school. To speed up the process, I asked Randy who could have done it. I got the names and addresses of his primary suspects, then centrally located myself in my car outfitted with T-hunting gear."

Sure enough, the profane transmissions started again shortly after school let out. Tom quickly got a bearing. "Bingo! From the bearing, I knew it was probably one kid, so I drove straight to his apartment building. I drove around the property while he was cussing, and the RDF antenna just kept pointing right at one window. He was using a subdued voice so family members would not hear the profanity."

Luckily, Tom was not spotted by his target as he circled the area. Once he was sure that he had the right residence, he made a transmission saying that he was out front and that the radio must be returned. "To our surprise, the thief complied," says AB5CK. "This eliminated the need to have the authorities search his home. We couldn't have been luckier!"

So AA5WJ's rig was quickly recovered. Tom left disciplinary action to the school, but he is sure that the incident was not treated lightly. Of course, stories such as this don't always have a happy ending, but it pays to be ready. Plan now, as there is no time to build your gear once a bootlegger or stuck carrier is on the air.

An Improved Bug Buster

Regular readers will remember an LED-readout "sniffer" project in the July and August 1990 "Homing In" installments. This hand-held field-strength meter (FSM) detects and shows the level of nearby RF from 10 to 2500 MHz. Teamed with a beam or quad for the frequency of the hunt, it will guide you on foot to a concealed fox, once you get close enough to pick up a few millivolts of signal.

That 1990 project uses the circuit board from the Optoelectronics Model CCB "bug detector," which features a pair of monolithic wideband RF ampli-

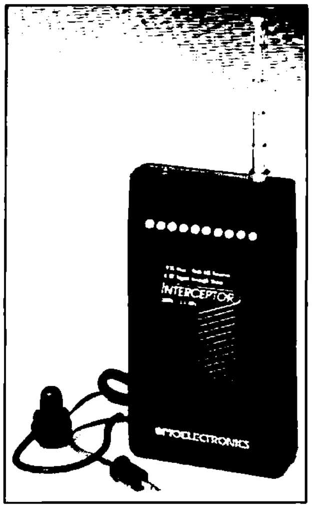


Photo A. At 4.1" x 2.4" x 0.8", the Optoelectronics model R20 field-strength meter fits into a shirt pocket.

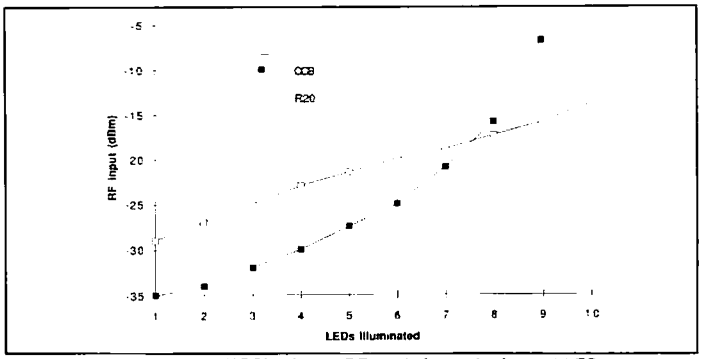


Figure 1. Measurements by KOOV of input RF levels for each of the 10 LEDs at 2 meters for both the CCB sniffer kit and the factory adjusted R20. The -29 dBm R20 threshold corresponds to 8000 microvolts across 50 ohms.

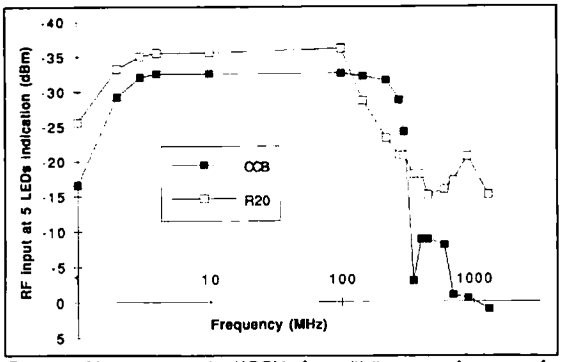


Figure 2. Measurements by KOOV of sensitivity versus frequency for the CCB and R20 at 146 MHz. The -36 dBm input level at HF and low VHF corresponds to 3500 microvolts across 50 ohms.

tiers and a bar graph display. With an upgraded voltage regulator and enclosure, the project cost about $70 to build.

Recently, Optoelectronics Engineering Manager Bill Owen KD4HGT enhanced the CCB circuit, shrunk it to pager size, added amplitude modulation detection, and renamed it the R20 AM Interceptor, shown in Photo A. With surface-mount technology and chip components, it has a dramatic improvement in UHF and microwave sensitivity.

An LM3915 logarithmic bar graph IC drives the display, so each successive LED represents approximately a 2 dB increase in signal strength (Figure 1). This helps you guess your distance from the transmitter. If you don't like the factory settings for zero and full-scale RF levels, you can modify them by tweaking two internal controls.

Using the supplied non-resonant R20 antenna, my 1/2 watt 2 meter fox transmitter with 19" whip was detected (one LED) 140 feet away. All 10 LEDs were on at 45 feet. On the other hand, a very low power transmitter (49 MHz cordless phone handset) did not light any LEDs on the R20 until it was 13 inches away.

With a four-element 2 meter quad connected to the bare R20 circuit board, detection range of typical 1 watt foxes will be several hundred feet. Of course, as in the car commercials, your results may differ, depending on transmitter power, antenna, multipath, and effects of other RF sources in the area.

As Figure 2 shows, the R20 is slightly less sensitive than the CCB on the 2 meter and 125 cm bands, but it is more sensitive elsewhere in the spectrum, particularly at UHF and above. The R20 showed the normal leakage from my microwave oven (2400 MHz) at half-scale indication, compared to quarter-scale on the CCB.

Coupling capacitors in the CCB and R20 are selected to roll off response below 4 MHz. I could not hear audio of a 50,000 watt AM station with it until I was a block away. The display read only half-scale when I was 100 feet from the tower! So don't try to use the R20 to hunt signals on 160 through 40 meters or in the AM broadcast band. This rolloff was designed in deliberately. Without it, sniffed-out VHF signals would be QRMed by local AM broadcasters and covered by 60 Hz hum from nearby power wiring.

Supply current drain is 25 milliamperes with no LEDs on and 84 mA with all 10 lit. There are no indicators for power on or low battery. Specified life of the standard 9-volt battery is three hours minimum, but this is very conservative. I measured full sensitivity operation down to 6.1 volts, thanks

to a low-dropout LM2931 regulator inside. Besides, you can sniff out the T in less than three hours, right?

The supplied whip antenna conveniently telescopes down to fit entirely in the R20 case, but it is only 12 inches long when extended. No external antenna jack or RF ground return connection is provided. That's fine for quick checks of your 2 meter handheld or for listening to the local airport tower as you sit in the terminal, but for bearings with your directional antenna, you will need to make some modifications.

For serious T-hunt work, consider removing the 2.6" x 2.1" circuit board from its plastic case and mounting it into a small metal box with a BNC or UHF connector for your RDF antenna. I suggest you choose a box big enough for two batteries and a selector switch. With a spare, you can quickly recover from "battery death" in the middle of sniffing out the hidden T.

While the R20 does a good job of receiving nearby AM-mode aircraft band transmissions, KD4HGT of Optoelectronics warns against using it on your next flight. Even though it has no oscillators to interfere with communications or navigation systems, he says it is illegal to operate it on a commercial aircraft.

FM signals cannot be demodulated by the R20 under normal circumstances, but they "quiet" the background hiss. This phenomenon can help identify FM emitters. Occasionally, the audio of an FM transmitter is readable if multipath (signal reflections from buildings, walls, etc.) causes two or more signal components to arrive at the R20 antenna at approximately equal levels but with time/phase differences.

If demodulating near-field FM signals of unknown frequency is important to you, consider upgrading to the larger and more expensive ($359) Optoelectronics R10 FM Communications Interceptor.

The R20 has no volume control. I found that earphone volume on 100 percent modulated VHF AM signals is comfortable, but might be inadequate in places with nearby loud noise. In any case, you should have no problem figuring out whether the AM signal you're tracking is CB, aircraft, ELT, amateur, or something else.

Unlike the CCB, the R20 is not sold in kit form. The suggested retail price for an assembled/tested unit is $119. It is available from the manufacturer and some ham radio dealers. For more information, write Optoelectronics, 5821 North East 14th Avenue, Fort Lauderdale FL 33334 or phone (305) 771-2050.

Computerized Display Update

A lot of hams are also digital enthusiasts, so it's no surprise that interest remains high in computerized systems for mobile RDF bearing taking and processing. Jerry Boyd WB8WFK recently reported his progress in upgrading his setup, which was described in "Homing In" for January and February 1993.

Jerry uses a manually-rotated 2 meter beam with the mast angle (azimuth) and signal strength sensed, digitized, and plotted by a laptop computer. Recently, he replaced the analog potentiometer azimuth sensor with a Hewlett-Packard 10-bit shaft encoder. 'The encoder works great, much better than the analog pot," Jerry told me. "I got a James Millen gearbox, so I have the analog pot and the encoder on the same shaft."

Much of Jerry's effort has been toward speeding up the system. As described last year, it took data for 25 seconds, then plotted 256 bearing points and calculated azimuth of the best bearing. "The original 10-per-second sample rate was not fast enough," WB8WFK says. "The data between points was real ragged. Now I have so many points that you can see the shape. Even on a noisy signal that barely raises the S-meter, you can actually see the shape of the lobe."

WB8WFK's new laptop computer has a 386 CPU running 25 MHz with a VGA liquid crystal display. This allows him to eliminate the external Micromint Z8 board. Azimuth and signal strength data from the analog-to-digital converter unit now goes directly into the computer through the parallel port at much higher speed.

Jerry's new plotting software is written in C language. "I have two new trigger modes to start data taking. I can trigger on antenna rotation or signal strength. Usually, I wait for the carrier to come on, then start spinning the antenna. When it detects motion, it starts acquiring data at 200 times per second, then automatically plots.

"Also, I have an overplot mode, similar to a storage oscilloscope. If I start turning again, it takes data again without erasing the previous plot, so two plots are now visible. I can save data to disk, but only data from the most recent sweep. The software also provides correction for vehicle heading. When you enter in the reading from my car compass, the software corrects the display to be relative to true north."

Jerry is a regular participant in Albuquerque T-hunts, which begin at 9 a.m. on the first and third Saturdays of every month. The starting point is on the University of New Mexico campus and the frequency is 146.565 MHz simplex.

WB8WFK would like to compare notes with others who are experimenting with computerized bearing displays for rotating VHF yagis and quads. You can write to him at his *Callbook* address. Of course, I'm eager to hear of your new RDF ideas and devices, too. Write to the address at the top of this column or send e-mail to JoeMoell@cup.portal.com (Internet) or 75236,2165 (CompuServe). My packet address is KØOV@WB6YMH.#SOCA.CA.USA.NOAM. 73

Number 16 on your Feedback card

HAMS WITH CLASS

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Payload Packaging

Twice a year my school district in Staten Island, New York, has a professional growth day for the teachers. Various workshops are offered for teachers to get enrichment and to expand their expertise and teaching techniques. In November I was fortunate enough to get into one of the NASA workshops, along with 200 other teachers in the district. The NASA workshops were so popular that they had to run five of them simultaneously.

The seminar ran all day, and each NASA instructor covered a great deal of information. They each emphasized their own area of specialization, such as chemistry, physics, or aviation. You should have seen grown-up people who happen to be teachers making paper airplanes and flying them around the room. At most NASA educational workshops tons of material is distributed. At the "paper airplane" session I got a wonderful activity book called *Sky School*. There are at least five lessons in this book that would be an excellent addition to the curriculum of a ham radio program.

When I do a unit on space travel and communications with my sixth, seventh and eighth grade ham radio classes, I like to include something new every term. There is a plethora of charts, maps, photos, books, and pamphlets available from the NASA Teacher Resource Centers across the country. Some of the materials are free; most of the others are inexpensive. I've included a very useful address for teachers at the end of this column.

Any instructor who uses SAREX lesson plans and activities in the classroom will find the "Payload Packaging" lesson to be a terrific experience to add to your repertoire. The topic areas are: a. Protection from vibration, acceleration and deceleration; and b. Shock absorption.

The materials required per student are one raw egg and one container with the following restrictions: no larger than 6" x 6" x 6"; must weigh at least one pound (total weight with egg). Other materials include assorted packing materials, cups for the eggs, a trash can to dispose of the packaging, large trash bags, triple beam balance (especially if density calculations are used), a ruler for volume measurements, a stopwatch for drop times, and newspapers.

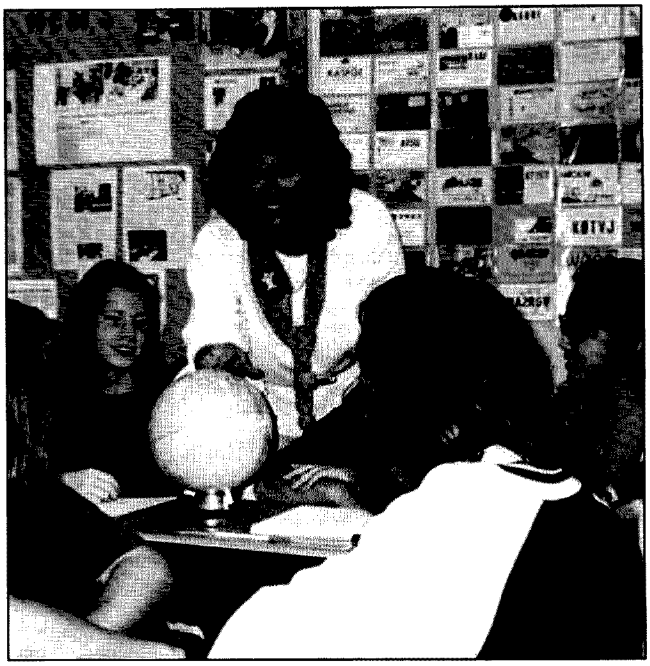

Photo A. The NASA enrichment lessons expose youngsters to career opportunities and introduce them to new interest areas for hobbies.

The Lesson

Pivotal question: Can an egg be packaged in a container so that it remains unharmed after being dropped from a height of at least 30 feet?

Background Information: Although shock absorption is an important part of aeronautical engineering, this activity emphasizes creativity in design. A background discussion should solicit the many commonplace uses of cushioning. Examples might include the evolution of tires, padded rails on school buses, rides in amusement parks, baby car seat requirements, and food packaging.

Suggestions: Prepare the class for this activity at least one day ahead of time. Suggest ideas for the variety of packaging materials students can try for packaging the egg. (You might want to add the restriction that no money be spent on this assignment). Provide newspapers to cover tables for the egg-drop. Be prepared for a mess when some of the eggs break. Students should package the eggs at home. Prepare a "cut away" package for display.

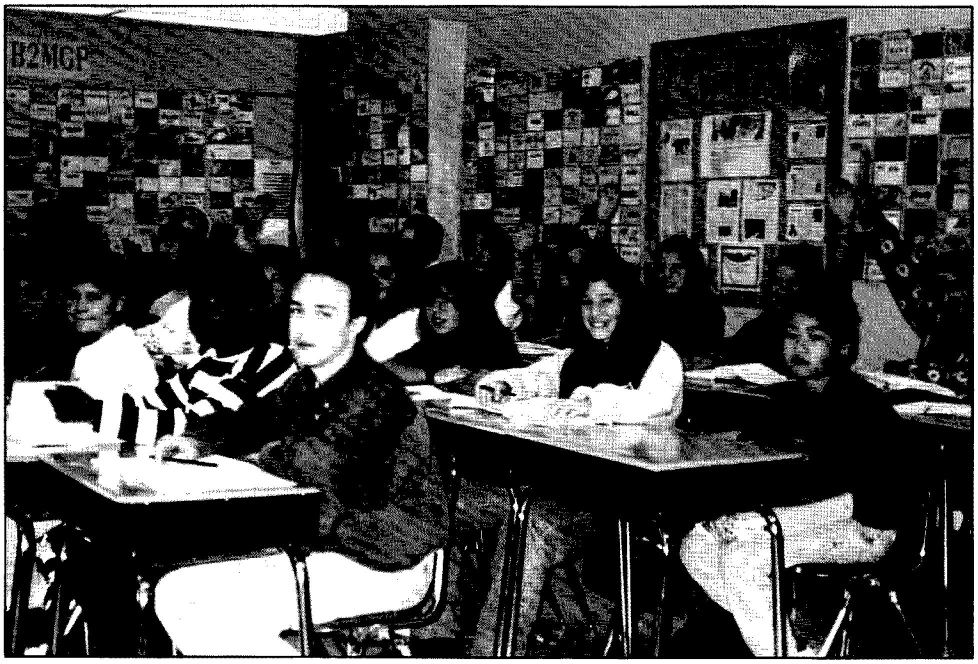

Photo B. Ham radio classes love to do enrichment activities from the NASA educational programs. In this photo, students brainstorm for the "Payload Packaging" lesson.

Procedure

1. Assign the students to prepare a container with the above mentioned restrictions, in which they have packaged a raw egg. Encourage students to package their eggs with materials they believe will prevent it from breaking after being dropped from a minimum height of 30 feet.
2. Have students bring in their boxes. Provide arrangements to verify size and weight. Provide labels for students to write their name on for the boxes.
3. Have students complete handout, "Payload Package Drop."
4. Go around the room and have each child describe what materials he or she used to package the egg. List the items on the board. Have the students predict which eggs will make it in five categories: a. Survival in good health; b. Living . . . but with cracked skull; c. Unconscious, with brain damage; d. Total scramble; e. Missing in action.
5. Drop the egg packages, one at a time, from a height of at least 30 feet.
6. Bring the "dropped" packages back into the classroom, where students open them.
7. After everyone has checked their eggs, count up the number of eggs in each of the categories and, as a class, record the results.
8. Discuss results of egg-drop activity. Assess and rank-order the quality of materials for shock absorbency. Highlight possible modifications in design for packages with eggs that did

not survive. Interpret the usefulness of shock absorbency to areas other than flight.

Review of what the students will do: They will discuss payload packaging. Students will design a "blueprint" for the design of a package for the raw egg. They will construct a container to protect a raw egg. They will record and discuss data and results.

Follow-Up

Here are some good suggestions for follow-up activities:

1. Provide awards in various categories—best decorated package, most colorful package, most unique package, most likely to scramble, survival of the fittest, and messiest.
2. Have the students drop the boxes with a homemade parachute, balloon, or other air-drag device.
3. Package multiple eggs.
4. Investigate existing designs in running shoes.

Information Sources

The Sky School Instructors are Patterson Biggs, Aerospace Education Services Project, NASA Headquarters, Code XEO Washington, D.C. 20546; and Debi Dyer at Science Instructional Specialist, Virginia Beach City Public Schools, Virginia Beach, VA 23456.

"Any instructor who uses SAREX lesson plans and activities in the classroom will find the 'Payload Packaging' lesson to be a terrific experience to add to your repertoire."

NASA's Central Operation of Resources for Educators is known as CORE. It was established for the international and national distribution of NASA-produced educational materials in audio-visual format. Educational materials include videotape programs, computer software, and slide and filmstrip programs that chronicle NASA's state-of-the-art research and technology. To apply for the CORE catalog, contact: CORE Lorain County JVS 15181, Route 58, South Oberlin OH 44074; phone: (216)774-1051 Ext. 293 or 294.

For more information about how to get your school involved with the SAREX (Shuttle Amateur Radio Experiment), write to: Educational Activities Department, ARRL, 225 Main Street, Newington CT 06111.

QRP

Low Power Operation

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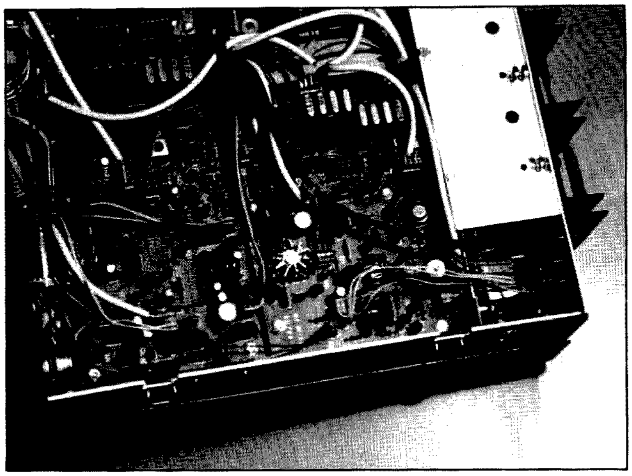

Photo A. The two crystal filters are clearly shown in the Argosy II. The 100 watt input PA is hidden under the shield.

The Argosy, Continued

The original Argosy, the model 525, was introduced in the summer of 1981. The basic rig went for $549. The 525 was discontinued in the summer of 1983 to coincide with the arrival of the Argosy II, the model 525D. The base price for this rig was $599. The Argosy II was discontinued early in 1988 at a price of $745. Many thanks for Tom Salivetti of Ten-Tec for digging up those details from the Ten-Tec archives.

The Argosy and the Argosy II have been in demand ever since they were introduced back in 1981. So, it's not surprising to see hams making modifications to these rigs.

In an issue of (the now defunct) *Ham Radio* magazine several years back, an article appeared on modifying the Argosy. For the life of me, I cannot locate the issue or identify the author of the work. I do know it was quite extensive and included a digital readout for the Argosy I. In fact, I've been told, some of the receiver modifications were included in the Argosy II by Ten-Tec. If my memory serves me, the modifications were rather heavy-duty. They were definitely not beginner mods you would make in an afternoon soldering session. If you know the name and call of the author, and the month and year of the article, how about dropping me a line? I'd like to tell others about this piece.

RF Gain Control Mod

One of the most common complaints about the Argosy is the lack of an RF gain control. The modification I'm describing requires you to do some soldering directly to the PC board of the Argosy. If you don't feel comfortable doing this, then don't! The modification is simple, requiring only a potentiometer, a diode, a resistor and a soldering iron. This RF gain control modification is by Ten-Tec from their QTC bulletin TN2-525.

You'll need a dual concentric 10k potentiometer. Remove the audio gain potentiometer. Connect the original audio control wires to the center potentiometer. Refer to the schematic in Figure 1. Connect the rear section of the potentiometer as shown. With that done, you now have a variable RF gain control and audio gain on the same potentiometer. But, you'll end up losing the power switch. You must then either turn off the power supply to the Argosy or use the magnetic circuit breaker if you're working from a 12 volt battery supply. I don't know if this modification will work with the Argosy II—I haven't tried it.

To eliminate the dual pot for the above modification, wire in the noise blanker so it's on all the time. This frees up the noise blanker switch. You can use the noise blanker switch to turn on the above circuit. A small 10k trimmer would replace the panel-mounted potentiometer. You end up with a fixed attenuation pad of say 10 to 20 dB. A hunk of perf board would hold the parts inside the rig.

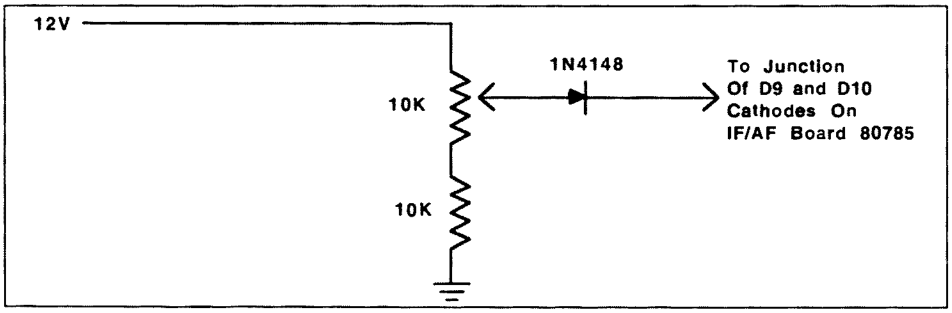

Figure 1. Schematic for the RF gain control modification to the Argosy.

Dial Light Mod

Another popular modification centers on the dial light for the meter. In the Argosy II, you can turn off the LED display, but the meter light still remains on. The modification is simple: You just rewire the meter light so it is controlled by the same switch as the display. So, when you turn off the display, the meter light goes out, too. This really saves the juice when working from a battery supply.

More Goodies

Since you can have your choice of crystal filters with either model, some of you may not know that the basic four-pole 2.5 kHz filter may be swapped out for a narrower filter, an eight-pole with a 2.4 kHz bandpass. It's a Model 220 filter. Most of the crystal filters are still available from Ten-Tec. The same goes for instruction manuals and most of the parts making up the Argosy series.

Another little-known fact about the Argosy is its ability to drive an ampli-

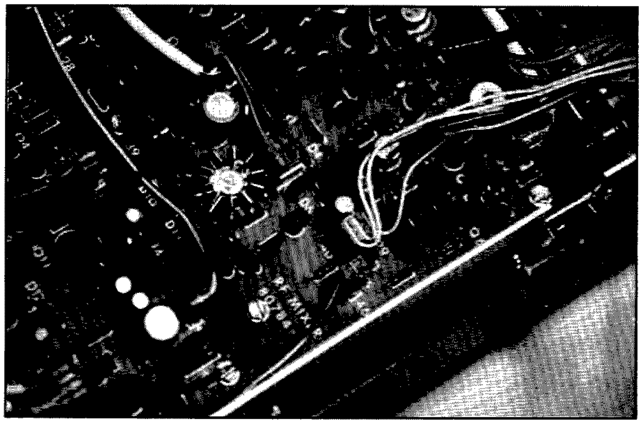

Photo B. These two trimmer pots set the ALC for high power and low power.

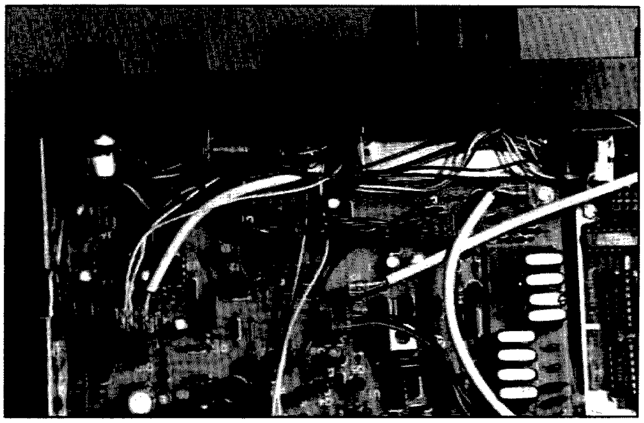

Photo C. The meter lamp can be easily turned off with the LED display.

fier. Granted, the 50 watts of RF output won't drive your Heathkit SB200 full blast, but you can make it work. Randy KD8JN drives his Heath amplifier with an Argonaut 509. He won't say how much he gets out, though.

Ten-Tec made a small PC board which would fix inside either Argosy. Their part number for this module is 80853. This module would provide a delay break-in to control an external amplifier. It's a rare find. If you wanted to, you could easily make your own control board to do the same function as the 80853 board.

There are two more easy-to-do modifications for the Argosy II. They involve the setting of the ALC trimmers. There are two trimmers on the 80784-D board. One sets the high limit for the high power position while the other will control the low power position. If you're are a real QRP nut, then 5 watts output is way too much power. By adjusting the ALC trimmer, you can have the power level you want and still have full ALC control. This is something the original Argosy did not provide. I have the ALC set for my QRP position at 2 watts. Since my power supply is my battery bank, its nominal voltage is 12.5 volts, so I have the ALC set for high power at 40 watts RF output. Higher output power is possible, but the ALC LED won't light when operating on the battery supply.

"*Like I said,* You'll have to pry my cold dead fingers off of my Argosy II."

If you have a dead transmitter on an Argosy I, I'll put my money on a blown driver transistor on the RF/mixer board #80784. It's Q3, the one with the small heat sink. It seems if you switch from high to low power while transmitting, you'll pop Q3.

If your Model 525 will not read forward RF power, check diodes D6, D7, and D8. Also check for continuity on L15. It has a tendency to become open. All these parts are located on the SW/low-pass filter board #80805.

Even though they are no longer made, both the Argosy I and Argosy II can still be heard on the ham bands. It's really rare not to hear one during a QRP contest. At Dayton, it's very common to see a sign on someone's back reading, *Want to buy Argosy I or II.* Like I said, *You'll have to pry my cold dead fingers off of my Argosy II.*

Number 18 on your Feedback card

PACKET & COMPUTERS

Digital Amateur Radio

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Getting Started with TCP/IP, Part 5: AUTOEXEC.NOS

[This column is Part 5 in a series on using amateur TCP/IP. In this series we are using KA9Q NOS in the form of JNOS (WG7J) version 1.07b or 1.08c. The software is available in the "Packet & Computers" area of the 73 BBS: (603) 924-9343, 300-2400 baud, 8 data bits, no parity, one stop bit.]

The primary configuration file for NOS is AUTOEXEC.NOS. This file functions much like DOS's AUTOEXEC.BAT. Entries in it are executed as if typed in at the JNOS command prompt. JNOS also offers a facility to include other files in AUTOEXEC.NOS by reference.

Some entries in AUTOEXEC.NOS are position-dependent—that is, certain statements must precede them to get the expected result. For the most part, though, the order in which statements appear in the file is arbitrary. In order to easily learn about the AUTOEXEC.NOS file, we'll divide it into logical sections. These sections are not enforced by JNOS—they are a convenience for us.

Let's take a look at the conventions used in the AUTOEXEC.NOS file. Below is a typical entry:

```
isat        yes        # 286/386 clock
```

"isat" is the parameter that we are setting (this tells JNOS that you are using a 286 or better clock). Separated by an arbitrary *white space*—spaces or tabs—is, in this case, a binary switch. It is called "binary" because it is either on or off. Most JNOS commands that use binary switches accept a variety of values: y, yes, true, on, 1, set, enable (to turn a feature on); and n, no, false, off, 0, clear, disable (to turn one off). The "#" precedes a comment. Whatever follows a # on the line will be ignored by JNOS as it processes the file.

Creating a Working AUTOEXEC.NOS

Let's start our look at the entries that are necessary to produce a working JNOS station. These are the entries that create a basic configuration which will let you get your JNOS station on the air.

DOMAIN

The domain command sets or displays parameters related to mapping between names (e.g.: n1ewo.ampr.org) to numerical (e.g.: 44.48.70.21) addresses, and provides a way to add DNSs (Domain Name Servers) to your configuration.

This translation service is very important. To understand why, let's take a look at the two types of addressing. Numerical addressing is the "native" way that TCP/IP determines how to find a device on a network. Here's how it works: Each numerical Internet address consists of four bytes. Each byte—eight bits of information—can have one of 256 values. When an Internet address is written it is usually done by writing the value of each byte (in decimal notation—that is base 10 or "normal") separated by a dot (.). Internet addresses come in three classes—A, B, and C. Class A addressing uses just the first byte to distinguish the network; the last three bytes are for the "host" or device version. This sort of addressing is used when there are few networks and lots of devices connected. Class B uses the first two bytes for the network, which balances the number of available network and device address. Class C (you guessed it!) uses the first three bytes for the network address, the last byte for device addresses.

The most common addressing class used in the amateur TCP/IP world is C. Amateur addresses always start with 44. This is the address for the *domain* AMPR.ORG; the *name* ampr.org amps to the addresses that lie in the 44.xx.xx.xx address space. All amateur addresses assigned by IP coordinators are sent to a host at the University of California at San Diego called mirrorshades.ucsd.edu. This host acts as a *router*. This means that any time there is traffic anywhere on the Internet that starts with 44, it is sent to mirrorshades, which looks at the address and sends it on its way to the correct gateway.

The second byte in an amateur Internet address points to a particular region of the world. For example, 44.48.xx.xx is somewhere in Indiana, because of the 48. The 48, in this case, is the Indiana *subnet*. How the next two bytes are used is up to the local IP coordination mechanism. Here in Indiana, we have regional subnets (yes, you can have subnets in subnets). I am located in subnet 70. This makes my first three bytes: 44.48.70; add 21 to this and you have my complete address: 44.48.70.21. 21 is the host (I also call this "device," since it could be any sort of networked hardware) portion of the address. There

are up to 255 devices on the 70 subnet. Why not 256? Because, by convention, hosts are never assigned 0 addresses; these are reserved for networks. The address 44.0.0.0, for example, addresses the traffic to the ampr *network*.

OK, so now you have some idea of what the numerical address is and how to read it. What about the name stuff? Obviously the numerical address is not particularly user friendly. It is also absolute—that is, always points to the same machine or device. Names get around both of these things. First, it is a lot easier to remember n1ewo.ampr.org than 44.48.70.21. The first part is my call; the second is the name of the amateur Internet subnet. This formula works for most amateurs on Internet—though some use SSIDs (Secondary Station Identifiers, e.g.: N1EWO-1) or other names.

The other advantage of names is that where they map can change arbitrarily. For example, a while ago, in this column, I reported on K9IU and its Internet<—>amprnet gateway. In the piece I specified K9IU's numeric (Internet) address. Because of this, when the sysops of K9IU had to make changes to their hardware configuration, which moved the gateway to a new Internet address, they had to do a bunch of fancy footwork. Had I instead just told you about K9IU.AMPR.ORG, it would have been a simple matter for the sysops to tell mirrorshades that this name now mapped to the new address.

So this domain stuff is pretty important. Most of your domain name services will come from looking at a local file called DOMAIN.TXT—this file contains names and their associated Internet addresses. To do this name-to-address mapping, JNOS looks in the DOMAIN.TXT file and finds the entry that matches the name it is working with. This means opening the file, and parsing (reading and interpreting) it—a very (time-) costly operation. A TCP/IP conversation involves lots of packets, each with a header that might require this translation. Because of this, setting up the domain services can have an effect on performance.

The first setting we'll look at is the *cache* size. A cache is a space in memory which is set aside to store some particular sort of memory object—in this case, a name<—>address mapping. When JNOS needs to make a translation it will first look in the cache (much faster than opening and reading a file) and use what it finds there. If you have recently communicated with a station this information may reside in the cache and speed things up. The cache size is set with the command:

domain cache size <n>

where domain is the command, cache size is the subcommand, and <n> is the number of entries to be cached. The limit is based on available memory and the default is 5. You should set this parameter to a number large enough so that you usually don't have to open your DOMAIN.TXT file. You can tell if this is happening by watching for disk activity when your station tries to *resolve* a name.

The next domain subcommand of interest is "translate." This subcommand determines if JNOS will try to convert numerical addresses to names whenever it displays them (in trace mode, for example). This can be a real CPU hog, so unless you really need it, turning it off is a good idea. To do this, the entry should be:

domain translate off

The last domain subcommand for the AUTOEXEC.NOS needs some explanation. It involves the use of a Domain Name Server, or DNS. If you live within radio earshot of a real Internet gateway this may be of use to you. A DNS is a machine that has a comprehensive DOMAIN.TXT file. When you try to use a name that does not appear in your own DOMAIN.TXT file, JNOS will contact a DNS that you have specified. If the DNS has the name you are looking for, JNOS will add it to your DOMAIN.TXT. This is a great service if you can take advantage of it. The command looks like this:

domain addserver <host> <time out>

where domain is the command, addserver is the subcommand, <host> is the host ID of the DNS, and <timeout> is an optional timeout in seconds.

You can control whether your station updates the local DOMAIN.TXT based on the DNS server response with:

domain update <boolean>

where "domain" is the command, "update" is the subcommand, and "<boolean>" is on, off or one of the equivalents mentioned earlier.

Finally, you can turn your own station into a DNS using the command:

domain dns on

where "domain" is the command, "dns" is the subcommand, and "on" enables the DNS server built into JNOS—the default is off.

Next month we'll continue with AUTOEXEC.NOS, taking a look at interface configuration. (NOTE: A working JNOS AUTOEXEC.NOS file is available on the *73* BBS in the "Packet & Computers" file area. The file is named: JNOSAUTO.TXT.)

Number 19 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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The winter weather and all of its ill effects should keep you indoors awhile, leaving you more time for in-house construction projects. Continuing along with that theme, this month I would like to cover a few little gems to keep you and your soldering iron busy. Let's consider construction of preamplifiers for the low VHF range. This month I'll cover component selection and parts substitution, and how to modify circuits accordingly. The primary goal is to use components you have on hand. Consider a dual-gate MOSFET preamp for 30 MHz. See Figure 1 for the schematic details.

The amplifier shown in Figure 1 can work well over the frequency range of 10 to 50 MHz. The 40673 dual-gate MOSFET is capable of higher frequency operation; however, there are better devices today for those applications. If you want to build this circuit it will work; however, it is primarily used for component selection examples. With the schematic diagram (Figure 1) in mind, let's go shopping for parts. Don't go and purchase everything brand-new—a lot of retailers would appreciate that, but rather see what components you have on hand that can fill the bill to hold down costs and keep the project in a "hobby" realm.

Use the design in Figure 1 as a guide. It need not be followed exactly; most component values can be varied about 10% without changing the circuit performance. You do not have to use the exact material specified for the resonant elements (tuned circuits). Changing these components can be very cost-effective if you can use something you have on hand.

Let's take a closer look at the resonant elements, the inductors and the capacitors that form this part of the circuit. The inductors used in this circuit are two variable 2.1 microhenry (µH) coils and two 25 µH inductors. What do we go shopping for in the coil department? Two or three RFCs whose value is 25 µH and two 2.1 µH inductors for the resonant elements. The 25 µH RFC's role on the input is not very apparent. This RFC provides a ground return for both the input tuned circuit to the amplifier and a DC path for the detector diode to ground. See Figure 4. It also matches the diode's higher impedance. (Here is my chance to slip in some microwave activity). This preamplifier is normally used in WBFM applications for a diode detector in a microwave cavity. For 10 GHz, this is a section of waveguide, and for lower frequencies it could be a tin can called a polaplexer. It's basically a tin can or waveguide whose size/opening is the right dimension for the frequency of use. For 10 GHz, a copper pipe 1" in diameter is about right. For 1296 MHz, a one-pound coffee can is perfect. The diode detector is placed 1/4 wavelength at frequency from the back of the can and at 90 degrees in reference to the diode orientation. There are several ways this same coupling can be done but this is the most inexpensive method. Such a detector diode has an impedance of about 200 to 400 ohms, and when coupled to a preamplifier it will deliver maximum when the amplifier input circuitry is matched to this same impedance range, hence the input circuitry.

The output inductor (RFC) is used to separate RF and DC. It drives up DC power from the output coax and powers the amplifier for operation in a remote location from the main station equipment. The other two coils comprise the tuned circuit and are shown as variable coils. They can be fixed if we wish to make the capacitor (15 pF) variable. The circuit will work well either way with variable coils or variable capacitors. This is one of the cost-effective choices to make by using your "junk box."

What form can the inductor take to make the circuit work? As an example, take a toroid that is capable of working at 30 MHz. Look at Table 1. Looking at toroid cores from Amidon Associates, a popular amateur parts supplier, we determine that a T-XX-6 or T-XX-12 core is suitable.

At this point the -6 (yellow core) is the most important ingredient. The table states that a -6 core is good for 10 to 90 MHz use. A red core -2 could be used, but the frequency stated is not suitable; it's good from 1 to 14 MHz max. Alternately, a -12 core (green and white) would work, but that's kind of overkill; put this idea in the "might use" category. A -6 (yellow) core would be an easier core to locate in the junk box as it is very popular, more so than a -12. In either case, let's use the -6 yellow core and proceed to wind a 2.1 µH inductor.

The Amidon charts list the toroid cores by core size (the XX above) and type (-2 or -6 or -12, etc.). Amidon has published a numerical value called "AL" or (µH per 100 turns). With this "AL" value for a selected core size we can compute the exact number of turns for our 2.1 µH inductor. Let's select a T-25-6 core. By the way, the "25" of the part identification number refers to the size of the outer diameter of the core, in this case 1/4". In comparison, a T-37-X would be a core with a 0.370" diameter. Now, looking at Table 1, the "AL" value for the T-25-6 core is 27. That means that for 100 turns on a T-

25-6 core the inductance would be 27 µH. (Note: We might not be able to get 100 turns on this size core, but this is a figure used for calculations only and not actual winding). To determine what 2.1 µH would be, a little math is needed.

Table 1 shows inductance if you were able to wind 100 turns on various type cores. On some smaller cores it is impossible to wind 100 turns so this number is imaginary but it is used in calculating the required inductance from that "AL" number.

The formula to determine the turns required is as follows: turns = 100 times the square root of the required inductance. A required inductance of 2.1 µH divided by an AL of 27 equals 0.07777777. The square root of 0.07777777 is 0.278886675, and that times 100 equals 27.888. So we need 28 turns of wire on our T25-6 core for an inductance of 2.1 µH. For this application, a wire size of #28 to #30 gauge enameled wire would be used. Benefits from this selection are that the input and output toroidal coils would not couple between each other, minimizing a condition called talking or crosstalk. That's oscillation when the input of an amplifier finds the output.

Toroid cores maintain the magnetic field within the core structure and minimize external fields. You can verify resonance of your toroid and its capacitor combination by using an instrument called a grid-dip meter. Toriod cores are difficult to grid-dip without some external coupling added for test purposes. To grid-dip a toroid tuned circuit, put a turn or two on the core and make an external two-turn coil with a short section of wire. Couple the dip meter to the external temporary coil and you will read the actual toroid resonant frequency directly on the grid-dip meter. Adjust accordingly to meet your parameters. Add or remove turns or vary capacitance values to suit your requirements. Trying to do this without the link coil for testing is very difficult. See Figure 3 for this method of grid-dipping a toroid core.

An alternate to the toroid coil would be a small 1/8" or so diameter slug-tuned coil form. This form could be taken from an old TV set IF amp circuit or similar circuitry from a junk PC board. Remove the coil form and any windings on the form. For a 1/8" coil form (slug-tuned), 12 to 14 turns of #24 wire have worked well for me. You can experiment with the wire gauge and parallel capacitor using the same old grid-dip meter for testing before placing the coil and required capacitor in the circuit. I am trying to remember—I believe that I used a 25 to 40 pF capacitor to resonate the circuit at 30 MHz. A factor in this case was that the coil form I used had a ground shield around the coil form and this affected the entire circuit. Also, using a selection from the junk box can lead to some uncertainly on what you have form-wise, but verification with the grid-dip meter will remove all doubt.

Remember to measure everything so it will properly fit in the circuit. Also, placing shielding in close proximity to the coil form can detune the circuit; keep this in mind when placing shielding. If you do not use a shield cover (can), there could be substantial coupling between input and output and other shielding techniques need to be employed. Give different methods a try as not much is at risk here. The benefit from this construction is cost because you are more likely to find junk coil forms than toroids. Check out stability and add

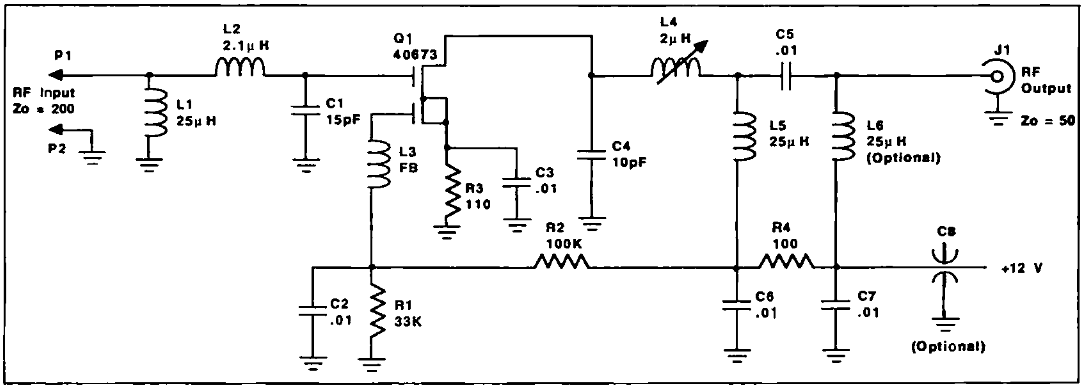

Figure 1. 30 MHz IF preamplifier schematic diagram.

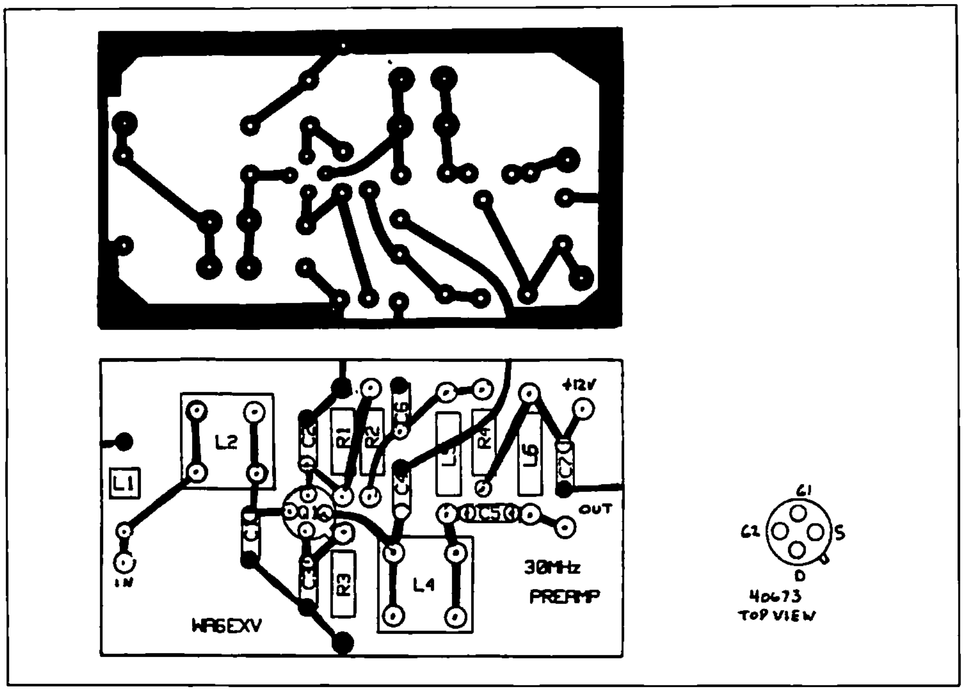

Figure 2. Drilled and etched PC boards for the 30 MHz IF preamp are available for $4 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

shielding if needed to make the circuit an amplifier instead of an oscillator.

Another consideration for the resonant circuit is to put a capacitor of 60% or so of total value in the circuit and use a small-value variable to make further adjustments. This can be a real benefit towards experimentation. I am not going to get into other considerations such as device substitution for the 40673 dual-gate MOSFET.

The tuned circuits that are used in the input and output circuit can take many different forms and the results will be nearly the same. Some experience can be beneficial but you aren't dealing with a high dollar amount so you can experiment and learn a lot through what I call the "Edison Effect." That's the procedure used by the renowned inventor Thomas Edison who, through many failures, created devices of excellence.

What I mean is that you should feel free to use a substitution component in different circuits and see what the results are. They might not all work well but I assure you that with a few tries success will be yours. If the design used fixed capacitors and toroid-wound inductors to a specific inductance, be assured that the creator of this circuit used an impedance bridge, or Amidon's coil chart, to determine the number of turns required. In either case, the exact component does not need to be used. Improvise something and try it out. What do you have to lose but time and a component you have on hand? Even if it does not work you have gained something from the school of hard knocks. Most of the time a substituted component will work and do it well.

One other thing to remember is that any coil you wind will vary from a stock circuit. Using Amidon's chart for the toroids they sell will result in a coil very near the inductance you desire. But, as with all things, it depends on how you distribute the wire turns on the core. Toroid cores wound for maximum efficiency have their wire spread or distributed over at least 80% of the core.

Slug-Tuned Coil Forms

You can replace toroid cores with small-diameter coil forms and fixed or adjustable capacitors and the results will be the same as long as coupling between the different coils is not great. Coils and capacitors can be preset before mounting to a circuit by checking with a grid-dip meter. This is actually an oscillator with an indicator and will indicate resonance in tuned circuits—a very handy instrument on the work bench. I have had several of them over the years and the grid-dipper I now use is a James Millen solid-state unit. There are many different models and they all are quite good. I have even seen some in military surplus for under $50.

Well, that's all I have to contribute on the selection of the components that seem to be most troublesome. The other components for capacitor values and resistor values need not be difficult and 10% or more tolerance components work out well. The only consideration here is in the capacitors that will carry RF; they should be selected from disc ceramic or mica types for good low-loss capabilities. If the frequency of the amplifier is increased to, say, over a GHz, then chip capacitors would be a better choice. Standard chip capacitors or surface-mount chip capacitors exhibit low inductance as they have no leads to hook them into a circuit. They are essentially leadless.

As you increase frequency again, from higher in the GHz range to over 3 GHz, special low-loss chip-type capacitors need to be used. These capacitors are still chip-type capacitors but are constructed out of special low-loss materials such as porcelain for a very high dielectric and low-loss characteristics at higher frequency microwave work. Each one of these levels in component parts represents a price increase for increased quality of the component. Disc capacitors are about a dime each, mica caps are 30 to 50 cents each, surface-mount capacitors are about 50 cents each, and high-grade low-loss RF types for microwave run from 50 cents to a dollar each. Just as frequency increases, so does the price and quality.

I hope I have given you some basic considerations for amplifier construction and when and what parts to try and select. I heartily suggest starting a junk box of components from scrap PC boards and old TVs and radios and whatever components you happen to locate at flea markets and swap meets. I have resisted the urge to pick up only what I want when I am shopping for components and if the price is right, I usually purchase far more that I will ever use. All these parts are stored away for "that day" and then I don't have to run off shopping and can use the time constructing on the work bench.

Mailbox

Raymond Elsner of Littleton, Colorado, writes, "Do you still have any of the 10 MHz frequency standards available?" (Model T-424, from *73*, August 1992.) Well, I'm sorry to say, no. They were an item that I picked up and when I offered them I did not know that they would be so hot. I did pick up all that the locals did not and made them available. However, now they are gone. If I ever locate some more I will let everyone know.

Arthur W1PXL is looking for a noise bridge for 144 MHz. He is trying to construct one. I saw a unit that was good to µHF in the *RSGB Handbook* and recommend the circuit to Arthur. I have never used a noise bridge as I am blessed with an HP-250 impedance meter that I use for antenna measurements. It is another way to verify antenna impedance. The HP-250 was more sophisticated in that you could determine at exactly what frequency from 30 to 500 MHz the resistive and capacitive components of the impedance product were. You could

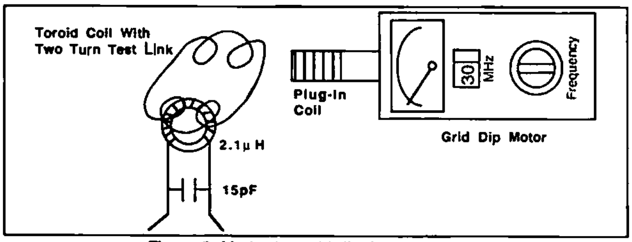

Figure 3. Method of grid-dipping toroid cores.

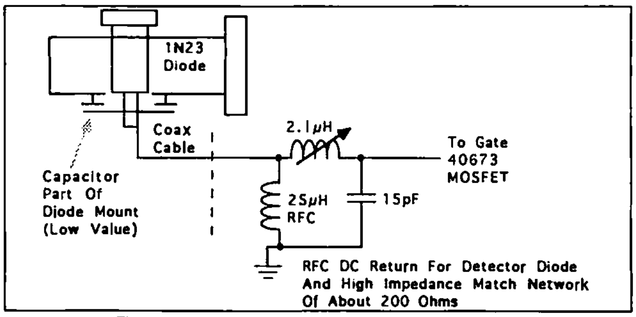

Figure 4. Microwave diode detectors matching circuit.

set an antenna to 50 ohms on the hairline. The long and short of it is that I have done just as well with a simple SWR bridge that was home-constructed. I guess it demonstrates just how well you want to match something or how accurate you need to be. The HP-250 worked great but, as with all large devices, it went out the door, replaced by something smaller. If anyone can help further, contact Arthur at 6453 31st Avenue North, St. Petersburg, Florida 33710.

Thomas KD4UIX is interested in an all-mode 2 meter radio at affordable prices. Well, Thomas, that is not the way most new radios are going today. It seems that the cry for more bells and whistles is being met by most manufacturers today and there is not an inexpensive 2 meter multimode unit on the market. The most inexpensive rigs I have seen are priced near $700. Next month, in response to this letter, I plan to cover a conversion approach for a microwave IF using a low-band SSB transceiver for obviously SSB generation, covering modifications needed. Later I will detail a simple 2 meter converter to tie the package together. There are several possible rigs that can fill the bill for inexpensive SSB radios such as the Radio Shack 10 meter SSB rig or other similar units.

Well, that's it for this month. Next month I will expand on the conversion of SSB rigs for microwave SSB use. As always, I will be glad to answer questions about this and similar subjects. Please send an SASE for a prompt response. 73 Chuck WB6IGP.

Table 1. AL Values (µH/100 Turns)

Core Type	RED -2	YEL -6	BLK -10	GRN & WH -12
T-200	120	105		
T-130	110	96		
T-50	50	40	31	18
T-44	57	42	33	
T-37	42	30	25	15
T-25	34	27	19	13
T-16	22	19	13	8

	MHz
RED	= 1 to 14
YEL	= 3 to 21
BLK	= 10 to 80
GRN/WH	= 50 to 200

(Core type and data courtesy of Amidon Associates, 12033 Ostego St., North Hollywood CA 91607.)

Number 20 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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It Hertz So Good

As I write this, we are in the midst of the holiday season. For most people, visions of Thanksgiving turkeys and Christmas presents have filled the relaxed, idle moments. For a techie like me, though, those musings mingle with such delicacies as frequency counters and resonant circuits. This month, let's take a look at frequency-related issues.

Count 'Em Up

What's the difference between frequency counters? What makes a good one or a bad one? The most obvious difference is in the maximum frequency the unit can count. Is faster necessarily better? In this case, pretty much. At least up to a point, anyway. If you never use anything higher than 2 meters, you probably don't need a 2 GHz counter, although it would pay to have one that goes to at least 250 MHz, just in case you need to count a local oscillator or something that goes above the band. But, there's more to a good counter than its frequency response.

Exactly

How precise is the counter? And how accurate is it? Those are not the same. If it tells you that your frequency is 14.208758423 MHz, that's pretty darned precise! But, if it's off by 300 Hz, that ain't very accurate. Conversely, if it tells you that the frequency is 14.2 MHz when it's really 14.208, that's quite accurate but not very precise. Generally, today's instruments have more precision than accuracy, and it can be quite hard to look at all those lovely numbers and not believe them. I see lots of counters on the market which have eight or even 10 digits, but I doubt many of them have the basic accuracy to back those numbers up. (By the way, that's true of some 3-1/2 and 4-1/2 digit DMMs, too.) To be sure, take a look at the specs and you should find some statement of basic accuracy, such as +/- 10 ppm or +/- 300 Hz after warm-up. The Hz statement is pretty obvious, but what the heck is ppm? That refers to "parts per million." In the case of a +/- 10 ppm counter, it means that, if your measured frequency is 14 MHz, the counter could be off by as much as 140 Hz in either direction, because it can be off by 10 Hz for every million Hz you're counting. So, just multiply 10 (the number of ppm) times the number of megahertz and you know what the true accuracy limits are. And even if the display shows digits right to the single Hz, those numbers may be lying if the accuracy isn't high enough. Of course, you have no way to tell for sure, and many instruments perform considerably better than their worst-case specs. The moral here, though, is not to go tweaking your radio down to the last Hz just because your counter says to, because it could be the counter that's wrong.

Check, Please

Is there a way to know when your counter is right or wrong? Sometimes. Luckily, digital counters have no "slippage" of any kind between their reference oscillators and everything else. In other words, the counter's accuracy depends *entirely* on the reference's accuracy. If that reference happens to be at some multiple of 5 MHz, as many are, you can check it by listening to it with a shortwave receiver or HF rig. Just put the radio in AM mode and tune in WWV. Ideally, the counter's signal and WWV will zero-beat, meaning that your counter is dead on frequency. In the real world, though, it never happens. If the oscillator's adjustable, you can set it right on frequency, ensuring, for a while at least, that your counts will be correct. If it's not adjustable, try counting the beats. Once you know them, you can calculate the ppm of the counter. If you hear three beats per second, and you're tuned to 10 MHz, then you know your counter is good to 0.3 ppm, which is pretty good! The receiver's stability, luckily, doesn't play a part because, in AM reception, the carrier (which is what you're beating against) is provided by the broadcast station (WWV), not the radio. By the way, this method works well for *normal*, home-type *counters*, but it isn't accurate enough for extremely accurate laboratory counters, because the atmospheric fading and random changes in the length of the signal path cause even WWV's carrier frequency to shift by tiny, random amounts. But we're talking pretty small shifts here.

Ring Out!

Resonance is a topic that seems to confuse many people. Articles attempting to explain it often resort to mathematical formulae and statements like "resonance occurs when the capacitive reactance exactly equals, and balances, the inductive reactance." That's completely true, but it doesn't tell you a thing about what resonance actually *is*. The phenomenon of resonance is at the very heart of radio communication, so let's take a look at it.

Boiling

If you've ever played with a "Slinky" (and who hasn't?), you almost certainly can remember stretching it out and then flicking your end. The energy you imparted to it visibly deformed it in a moving wave down the spring until it reached the other end. It looked pretty cool, right? But what happened then? If you had the other end held rigidly to, say, a chair, the wave came right back at you, right? To me, that was always the niftiest part. Actually, it is exactly the

same phenomenon as a bouncing ball: the energy is reflected by the rigid boundary.

The time it takes for the energy wave to make one complete round trip is called the *period*, and represents one complete cycle. If you measure that period in seconds, and then divide one by it, you'll get the frequency in cycles per second, or Hz, of the round-trip time. So, if you get a period of 0.8 seconds, your frequency is 1.25 Hz. And, in case you're wondering, no matter how hard you flick the spring, the frequency will be exactly the same. The wave will be *bigger* but not faster, because the transit time is not determined by the amount of energy thrown in.

By What, Then?

The time it takes for the wave to traverse the spring is determined by the length of the spring, its tension and the stiffness of the material from which it's made. Try stretching the string tighter; the wave's speed will increase. And, of course, if you shorten the spring, the energy has less distance to travel, so, even though its speed is not increased, it takes less time to make the trip.

Let 'Er Rip

Let's say you flick the spring, and then you flick it again at exactly the moment the reflected energy returns. What happens? The reflected energy, which is going to reflect yet again towards the other end, adds to the new energy pulse, making it bigger. If you keep doing it, the wave will get absolutely huge. And that, gentle readers, is resonance.

Electrically Speaking

In an electrical system, energy travels through a wire at approximately the speed of light. That may seem awfully fast, but it really isn't when you want to make millions or even billions of round trips per second. But the idea is the same—electrons have a fixed speed, and the length of the wire determines the transit time. But, you may be asking, why does the energy reflect back from the end of the wire at all? Well, the end of the wire represents an impedance boundary in much the same way as the spring's end represents a mechanical one. There's no place else for the electrons' energy to go, so it comes back at 'cha!

Reactance

Unlike in a mechanical system, though, the tension in the wire has no effect on the electrons' speed. But, there are other factors. Specifically, there are capacitive and inductive reactances. Notice I didn't mention resistance here; resistance makes the energy weaker by dissipating some of it as heat, but it doesn't slow it down. If it did, we could make delay lines and information storage devices out of resistors, and it would take measurably longer for energy to reach the other end of a 1 megohm resistor than it would for it to traverse a 1k resistor. It's a neat idea, but it just doesn't work.

By storing voltage charges in capacitance and current in inductance, though, we can, indeed, control the speed of the energy. And it's true, when the two kinds of reactance exactly equal each other in a parallel tuned circuit, they will cancel each other out, leaving only resistance, but with an overall slowdown of the energy. The result is resonance at a frequency determined by the sizes of the capacitors and inductors.

> **"One very useful device in which the mechanical and electrical systems meet is the crystal."**

The Twain Meet

One very useful device in which the mechanical and electrical systems meet is the crystal. Crystals actually do vibrate, but only very slightly. In doing so, though, they excite their atoms to produce electrical energy at the frequency of vibration. That frequency is determined by the physical characteristics, such as the size and type of cut, of the crystal. Because quartz (the most commonly used crystal material) has a molecular structure which is very dimensionally stable with respect to temperature, the frequency doesn't drift much. So, if we put a crystal in a circuit which causes it to excite itself at its resonant frequency, we've got one heck of a stable oscillator. In fact, without the stability of quartz crystals, electronics as we know it today wouldn't exist.

Skyhooks

Antennas are another resonant phenomenon. They're essentially the electrical equivalent of springs. The longer the wire, the more time it takes for the energy to make the round trip and the lower the resonant frequency. And, if we excite the antenna with energy that is *not* at its resonant frequency, the returning energy will interfere with, and partially cancel, the applied energy, resulting in an energy fight. We call that a "bad SWR!"

See you all next time. 73 de KB1UM.

73 INTERNATIONAL

Number 21 on your Feedback card

Arnie Johnson N1BAC
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N. Swanzey NH 03431

Notes from FN42

I received a phone call from Richard Sears KC4IBC this past week. He was looking for some information on Taiwan which I was not able to supply to him, but he is going to be there for some time, and he promised to send us some noteworthy information about the happenings on Taiwan while he is there. I hope that he has a chance to chat with our Hambassador to Taiwan, Tim Chen BV2A.

If any of you have decided to travel around this great world of ours in 1994, you might want to read the letter from Nat VU2NTA in India and Harris 9M6HF in Malaysia. Nat is a tour guide and Malaysia has declared 1994 the "Visit Malaysia Year." Contact Wayne and tell him where you think he should go on his wide travels this year and ask him to take you too. I must admit that I keep telling him to take me along but he wants me to pay for it. I would think that he would want to pay my way just because I'm such great company, but, of course, that's just my opinion. I do know that he and Sherry would love to become your tour directors.

I was sure glad to hear from Harris Abdullah 9M6HF after a several-year "dry" period.

That's enough from me for this month. As usual, many great reports from other hams and your Hambassadors follow. If you like what they are reporting to us, let them know! If you want something else, let them know! If you have some new information, let them know! They are only as good as those who provide them with information.—73, Arnie N1BAC.

Roundup

Egypt This is just another reminder that Egypt is hosting TELECOM 94, 25-29 April in Cairo, which will focus on the African region. Africa TELECOM 94, which follows in the footsteps of Africa TELECOM 90 in Harare, will continue the dialogue generated by those events. The International Telecommunications Union (ITU) will once again provide a platform for continued discussion and presentation of the latest concepts for the development of telecommunications in the region. This event will bring together high-level personalities from the academic and industrial world and will thus be a unique opportunity for all the countries to meet with partners with an interest in the development of telecommunications.

The exhibitors will be displaying a range of advanced and high-quality items of telecommunications equipment and related services. The Forum, a cornerstone of TELECOM, will bring together top government officials and policy makers from around the world. This event is thus of vital importance from the point of view of broadening the participation of countries in development activities.

For further information, contact Mr. Tom Dahl-Hansen, Executive Director, or Ms. Suzan Hee-Sook Lee, Project Manager, ITU, Place des Nations, CH-1211 Geneva 20, Switzerland, Tel: +41 22 730 5811 or Fax: +41 22 730 6444 or Telex: +412 000 UIT CH, or the Government of the Arab Republic of Egypt contact person: Mr. Ismail Ouf, Chairman, Cairo International Conference Centre, Nasr Road, Nasr City, Cairo, Egypt, Tel: +202 263 4637/16 or Telefax: +202 263 46 40.

India *Letter from Nataraj V., VU2NTA:* Greetings from India. I have always enjoyed reading your "73 International" column as it gives us an idea of what amateur radio is doing in other countries. *[Thanks, Nat!—Arnie]* In India, amateur radio is growing by leaps and bounds. From less than 1,500 amateurs in 1979 to around 7,500 in 1993, it has been a big growth. But most licenses exist on paper as many amateurs find it difficult to get a decent station on the air due to the high cost involved. The cheapest transceivers available to the Indian amateur is the FT-840, which costs around Rs. 45,000, i.e. about $1,500 U.S. This works out to be an average family's income for two years.

This has led to a huge effort in home-brewing, and many kits and ideas float around the popular bands in India—40m (7-7.1 MHz) and 20m. In South India, AM and CW have become very popular for home-brewers on 40m and SSB for those on 20m.

In spite of all this, what has gained popularity all over the country is 2m FM activity. 144-146 MHz is allocated to amateurs in India and major cities are seeing a spurt not only in 2m activity but 2m repeaters also.

Bangalore, in the south, was in 1987 the first 2m repeater in India open to all amateurs, followed by a second repeater in 1990. Next to follow was Madras with two repeaters. One repeater in each city is installed such that DX on 2m FM is possible and the other one is for use within the city. A third city to have two repeaters is Coimbatore in South India. Bombay, on the west coast, and Kodaikanal, a hill resort in South India, have one repeater each.

All this activity on 2m led to the starting of T-hunts (Fox Hunts, as they are known here). The first Fox Hunt in India was held on March 11, 1989. The Fox was Ganesh VU2TS. This hunt was won by Les VU2AK, Chandru VU2RCR, and Bhat VU2IFX, in a time of 45 minutes. There have been seven Fox Hunts so far, the last one on September 5. Prizes for winners have ranged from storage water heaters for the bathroom to wall clocks, wristwatches, Walkman-type audio cassette players, and certificates for all the participants. All prizes have, so far, been sponsored by radio amateurs, including fellowship and lunch after the conclusion of the hunt.

The other cities that have had Fox Hunts are Madras and Coimbatore. Fox Hunts are the times when you find that all participants are crazy.

All sorts of antennae can be found during the Hunt. Unlike in most countries, hunts here have more participants on motorcycles than in cars or station wagons. One will find three- to five-element yagis, quads, loop yagis, phased verticals, and the latest was a half-wave dipole with a corner reflector on a 250 cc. motorcycle-sidecar combination by Poru VU2GGM.

Bangalore was also the first city in India in 1986 to have a multiple hilltopping expedition on 2m. As many as six hilltops in South India were activated.

I will try to make further information available to all. If anybody has specific questions, please drop me a line along with an SASE.

I wish all a Merry Christmas and a happy, prosperous and peaceful 1994. 73, Nat VU2NTA. *[Nataraj V, 8, 100 Ft Rd; BSK 3rd Stage, 2nd Phase; 7th Block; Bangalore 560085, India.]*

[Nat also wrote a letter to Wayne to discuss Wayne's travels. Following is that letter and Wayne's response.—Arnie]

Dear Wayne,

Over the years of reading *73 Magazine*, I have found you travel around the world a lot along with your friends. How is it that you have not made a full-time tour to India? Is it that you could not find anyone to coordinate here for you or that you are not interested?

I have started a tour service for foreign groups and escort them myself. The tours in South India are by luxury coaches and have twin sharing accommodation at the best available hotels. For tours to North India, I do the ground handling but do not escort groups.

South India is vastly different. Every temple, fort, and palace is different, as is the culture, traditions, customs and life style in every village.

Do let me know if you would be interested so that I can customize an itinerary for you. South India is perhaps the most enchanting spot in India. The south includes the states of Maharashtra, Andhra Pradesh, Goa, Karnataka, Tamil Nadu, Kerala, and Laccadive Islands.

Unlike your other trips, it is not possible to get a reciprocal license to operate amateur radio but opportunities to meet radio amateurs and visit shacks will be arranged.

I look forward to hearing from you. With warm regards, Nat VU2NTA.

Continued on page 82

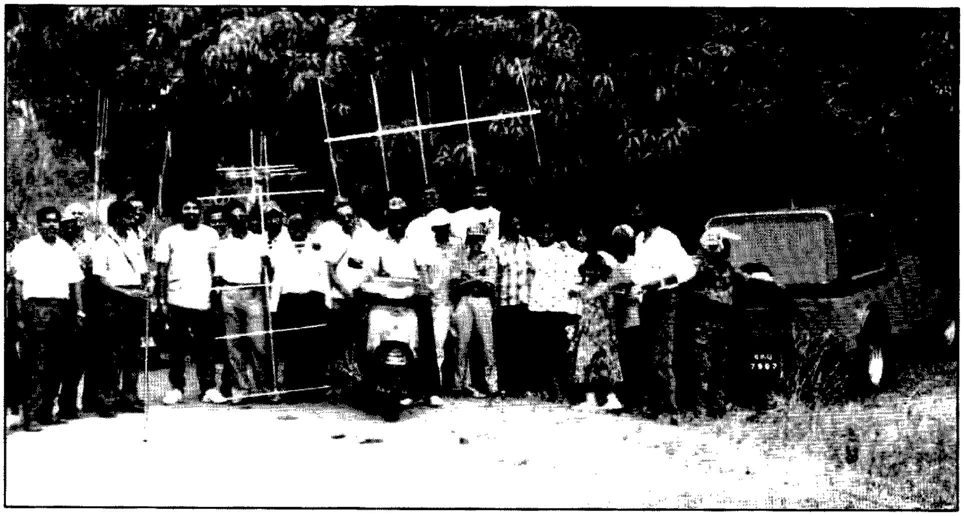


Photo A: Part of the gathering at one of the Indian Fox Hunts. Photo by VU2NTA.

73 INTERNATIONAL

Continued from page 80

Nat . . . Been traveling—Caribbean islands, San Francisco, Munich, Berlin, New York, etc. I'm off to Hawaii this afternoon [26 Nov 93] for two weeks. Cold fusion conference.

South India, eh? Well, dunno—I've done the New Delhi-Agra bit, complete with forts. What might be interesting to a ham group? I've taken ham tour groups to Europe and Asia (Japan-Korea-Taiwan-Hong Kong-China), but what would we have to offer them in Southern India? And how many do I need to round up for Sherry and I to be tour directors? Presumably costs are low in India as compared to here, so what do you estimate for the cost of a 10-day tour?

No chance for licenses, eh? We shouldn't bring our HTs?

I organized a ham tour many years ago that included Lebanon, Syria, Iraq, Iran, Afghanistan, India, Nepal, Burma, Thailand, Singapore, Australia, New Zealand, New Caledonia, Fiji, Western Samoa, American Samoa, and Tahiti. Great tour! That would be fun to do again, but I haven't got the time these days. Next month I'm starting still another magazine. So what can you do in 10 days in India?

Best regards, Wayne.

Israel The Israel Amateur Radio Club invites all radio amateurs and SWLs to participate in the Holyland DX Contest on the 2nd and 3rd of April 1994.

The object of the contest is to contact as many different Israeli amateur radio stations on as many bands and from as many areas as possible. It begins at 1800 UTC on the 2nd and ends at 1800 UTC on the 3rd. Each station may be contacted on both CW and SSB on the same band, which makes it possible to make up to 12 valid QSOs with the same station.

For further information contact Shalom Beltcher 4Z4UT, IARC, PO Box 17600, Tel Aviv 61176, Israel (SASE please). *[I will also try to get the entire rules on the 73 BBS in the "73 International" area (12), 603-924-9343, 300-2400 bps, 8N1.—Arnie]*

CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EA8
Apartado 11
35450 Sta Marie de Guia (G.C.)
Islas Canarias
Espana

The NW Radio Club (our zone Guia, Galdar, etc.) is having its second annual Fox Hunt, but they changed the name to "Treasure Hunt." Fox Hunt might not have gone over too well here as the word "fox" in Spain has some questionable connotations. It's nice to see a little more activity up this way. And maybe the club on the next island (Tenerife) will start sending me some news. I hope so. News from mainland Spain has dried up for now it seems. Maybe somebody there will take the "hint."

Most of you probably know that Europe depends heavily on bus transportation even though the number of cars is increasing rapidly. On the continent they also have trains, but we don't have any in the Canaries. The upshot of this is that I take the bus almost everywhere. Over the years this has led to some interesting events and conclusions, like about the character of different makes of busses.

In 1987, the only ones on the intercity line up here were Pegaso (Pegasus), old and tired, but still stout and willing. The terrain is mountainous and steep because the mountains are relatively recent and sharp-edged. That, plus frequent stops and starts, added to people with an impatient temperament, means that missed shifts and loose steering can be interesting. We have some pretty good grades and one approaches the second highest bridge in Europe (105 meters, 346 feet). I've watched drivers playing the loose steering on those bridges in a strong gusty crosswind and keeping well within their lane. This is doing more than it seems because everything is much closer and more critical in European driving than in the U.S. After six-plus years here I still have a tremendous admiration for their skill.

I also remember being in an old Pegaso grinding up the approach to the bridges, standing in the aisle (58 sealed, 30 standing) when it came time to downshift. No way; it just wouldn't go in, even with repeated trying. Meantime, the bus had really slowed down, but the only gear it would go into was the original one (fourth, I think). So we caught fourth but at a really slow speed, and went on up, even picked up a little speed! I watched several of the older passengers exchange knowing glances. It wasn't the first time they'd seen that happen. Those busses are tough, and still running after who knows how many years and probably millions of miles, because they're still used as spares.

Another time, we got stopped on the same hill—bad diesel fuel. It was just sprinkling rain, and I started talking to the driver about the rain. He said that with the older busses they had a lot of problems with the roofs leaking during the infrequent rain here. He said that at times he had to tell the people getting on and closing their umbrellas as they did, to leave them open because the roof leaked so badly!

This same driver saved my bacon one day. I had bought four heavy metal industrial shelves to take home on the bus. As I struggled up to the bus stop, there was the bus about to leave, across the very busy street. I'm pretty good at getting across busy Las

Palmas streets when I need to, but not with a cumbersome load like that. But I looked up and there was Marco at the wheel, so I call, "Marco!" He looked up. "Wait for me." And he settled back into the seat, ready to wait as long as it took me to get across. This would never happen on the line that serves the south, the tourist part of the island. I'm sure glad I live in the north.

Until next time, 73. Woodson N5KVB/EA8.

MALAYSIA

Harris Abdullah 9M6HF
PO Box 13329
88837 Kota Kinabalu
Sabah
Malaysia

I operated a BBS station on 2m for a month last April with a high expectation of getting others to try out this mode, but I managed to get only two amateurs interested. In the daytime, the BBS was on HF and downloading bulletins and mail from YB5QZ BBS on 20m, and in the evenings it was on 2m. But it was fun, and the experience gained will be put to good use when a BBS runs full-time here in the future.

The next project is the setting up of a P/C cluster here. JH1ROJ/9M6RO has contributed the software and TNC (DRSI-2). I will be operating the cluster and hopefully this new project will attract the others to go into the packet mode.

The *73* Hambassador from Hong Kong, Phil VS6CT, made a short visit here last April and was kept busy by the local hams. Phil made several presentations to various groups on his specialty—Maritime Distress and Safety Systems.

VS6CT is always on 21.227 MHz daily from 2300 UTC. Sometimes he is joined by HL9KT, BV2FA, KA6V (Phil's QSL manager), WB2KXA (from New Jersey), and myself. HL9KT and myself have a regular sked on 14.195MHz at 0900 UTC. If any of you wish to join in, please do so when you hear our signals.

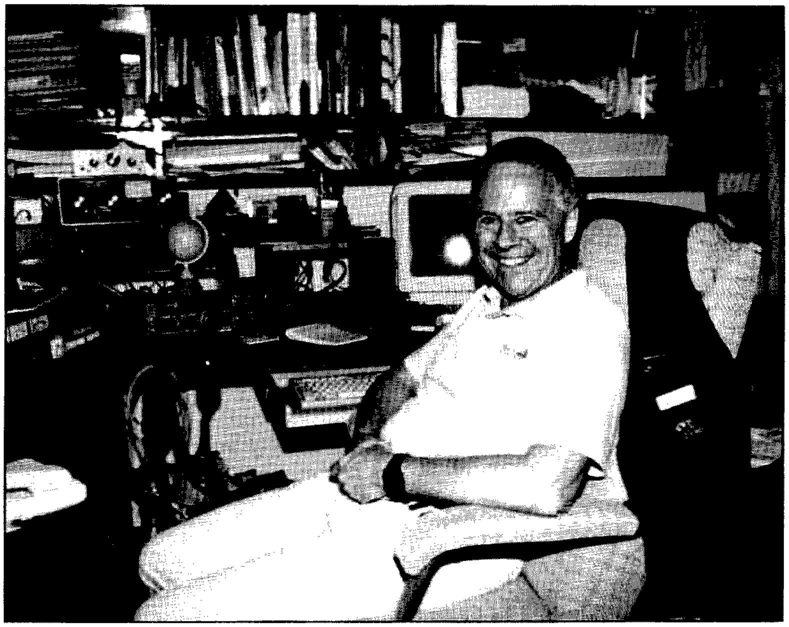


Photo B: Hambassador Phil Weaver VS6CT while visiting Hambassador Harris Abdullah 9M6HF.

Two new operators, Din 9M6LS and Armstrong 9M6BZ, check in regularly with the W7PHO Family Hour Net on 14.226 MHz. So does Johnny 9M6DB located in Miri, Sarawak.

JA9AG, a JARL Director for the "9" call area in Japan, came twice: November 1992 and February 1993. He operated 9M6/JA9AG at a place called Seaside Resort about 20 km from Kota Kinabalu.

1994 has been declared "Visit Malaysia Year." Those who have not made their holiday plans yet may consider a visit here. Temporary operating permits could be arranged if you desire to operate from here. Let me know via Packet Mail @JI3ZAG in Osaka, Japan, or drop me a line at my address.

73 from Malaysia! 73

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our BBS (603-924-9343). for listings that were too late to get into publication.*

FEB 5

CHARLESTON, SC The 21st annual Charleston Hamfest/Computer Show will be hosted by the Charleston ARS at Charlestowne Landing State Park from 8:30 AM-4 PM. Talk-in on 146.79- or 145.25-. VE Exams at 12 noon - Talk-in on 145.25- to get location. Walk-ins only. For Exams, contact *Ed KC4OOZ, (803) 871-4368; or Warren W4ZYZ, (803) 572-1164.* Flea Market Contact: *Jenny Myers WA4NGV, 2630 Dellwood Ave., Charleston SC 29405-6814.*

FEB 13

MANSFIELD, OH The Mansfield Mid'Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds beginning at 7 AM. Talk-in on 146.34/.94 (W8WE). For tickets/info contact *Pat Akerman N8YOB, 63 N. Illinois Ave., Mansfield OH 44905. Tel. (419) 589-7133 after 4 PM EST.* Send SASE with payments or inquiries by mail.

VANCOUVER, B.C., CANADA The Burnaby ARC will host their annual Flea Market at the Westminster Armouries, 6th St. at Queens, New Westminster BC. Doors open for sellers at 0900 hrs; buyers 1000-1400 hrs. Talk in on 145.35 (VE7RBY), or 442.85. For info, contact *the club net, Monday nights at 2000 local time on 145.35*; or write *Burnaby ARC, Box 72012, 4429 Kingsway, Burnaby B.C. V5H 4P9, Canada.*

FEB 19

SALEM, OR The Salem and Oregon Coast Emergency Repeater Assns. will co-sponsor the 1994 HAM FAIR, beginning at 9 AM at the Polk County Fairgrounds. Talk-in on 146.26/.86. For info write (with SASE) to *Salem Repeater Assoc., P.O. Box 784, Salem OR 97308.*

FEB 20

BRIGHTON, CO The Aurora Repeater Assn. will hold its 12th annual Swapfest at the Adams County Fairgrounds at 9755 Henderson Rd, from 8:30 AM-2 PM. Contact *Judi WD0HNP, (303) 450-6910*, or *Jan KA7TYU, (303) 699-1944*; or write (with SASE) to *Aurora Repeater Assn., P.O. Box 39666, Denver CO 80239.*

CUYAHOGA FALLS, OH St. Vincent's Bingo Hall, 3479 State Rd., is the site for a HAMFEST being sponsored by the Cuyahoga Falls ARC. Contact *(216) 929-4267, or Carol Hervol N8JLQ, 11192 Cottingham Circle NW, Uniontown OH 44685. Tel. (216) 497-7047.*

FEB 26

BISMARCK, ND The Central Dakota ARC will hold its annual Hamfest at the Radisson Inn, 800 South Third St., from 8 AM-4 PM. Talk-in on 146.85/.25. VE Exams. Ham/Computer Swapmeet. Get details from *Tim N0SDB, (701) 663-6620*; or *Chris N0POK, (701) 663-1324.*

JENSEN BEACH, FL The Stuart Outdoor Hamfest, sponsored by Martin County ARA, will be held at Langford Park, S.R. 707, at "The Arch," from 0800 UTC-1500 UTC. Talk-in on 147.060 (+600 MHz). Packet Demo. ARRL VE Exams begin at 9:30 AM (courtesy of Ft. Pierce ARC). Sign in at 9 AM. Contact *MCARA, P.O. Box 1901, Stuart FL 34995*; or *Bob Hess KA3EDL, (407) 546-4353.*

FEB 26-27

CINCINNATI, OH The ARRL Great Lakes Div. Convention 1994 will be held at the Cincinnati Gardens Exhibition Center, 2250 Seymour Ave. Exhibits open at 8:30 AM Sat. and Sun. Commercial vendors and Flea Marketeers are welcome. Convention Chairman: *Stan Cohen WD8QDO, 2301 Royal Oak Ct., Cincinnati OH 45237; (513) 531-1011.* Vendor Chairman: *Joe Halpin W8JDU, 11615 Geneva Rd., Cincinnati OH 45240; (513) 851-1056.*

FEB 27

DEARBORN, MI The Livonia ARC will hold its 24th annual Swap'n Shop from 8 AM-4 PM, at the Dearborn Civic Center. Talk-in on 144.75/5.35 and 146.52 simplex. VE Exams will be given in the afternoon of the Swap. For info, send 4x9 SASE to *Neil Coffin WA8GWL, Livonia ARC, P.O. Box 2111, Livonia MI 48151. Tel. (313) 427-3905.*

MARCH 5

ABSECON, NJ The Shore Points ARC will sponsor its 12th annual hamfest, "Springfest '94", at Holy Spirit H.S., Rte 9, 1/2-mi. south of Rte 30. Doors open at 9 AM (7 AM for sellers). Talk-in on 146.385/.985. Contact *SPARC, P.O. Box 142, Absecon NJ 08201.*

DENVILLE, NJ The annual North Jersey Hamfest, sponsored by Split Rock/West Morris, will be held on Morris Ave. starting at 8 AM (sellers 6 AM). VE Exams at 9 AM sharp. Sign up by 9 AM. Talk-in on 146.985 and 223.86. Contact *Bernie WB2YOK, P.O. Box 251, Flanders NJ 07836; (201) 584-4423.*

MARCH 6

NORTHAMPTON, MA The Smith Vocational School on Rte. 9 has been choosen as the site for the 10th Annual MTARA Amateur Radio Flea Market. This event will be presented by the Mt. Tom Amateur Repeater Assn. Inc., starting at 9 AM (8 AM for vendors). ARRL VE Exams at 10 AM. Vendor Reservation Contact: *Jim K1MEA, (413) 527-3199 eves. before 2200 EST.* VE Exam Registration: *Jim WA1ZUH, (413) 245-3228; or @ MTMBBS via packet.* Advanced registration strongly recommended.

SPECIAL EVENT STATIONS

FEB 12-13

EUGENE, OR A CW QSO Party will be held by the Quarter Century Wireless Assoc. Inc. from 0000 UTC Sat.-2400 UTC Sun. Frequencies: 30 kHz inside the CW bands. Regular call signs will be used for all contacts. Send logs to *Bob Reed WB2DIN, 597 Brewers Bridge Rd., Jackson NJ 08527.* For more info, contact *Bill Miller K2GCE, Activities Manager, 217 Porterfield Pl., Freeport NY 11520.*

EVANSTON, WY The Uinta County ARC will operate NW7H 1500Z-2400Z to celebrate the Chinese New Year. Phone 10X on 28.395, 24.945, 21.325, 18.140, 14.245. For a certificate, send QSL with a 9x12 SASE to *Vranish, P.O. Box 2048, Evanston WY 82931-2048.*

FEB 12-14

CLAREMONT, NH The 1994 New Hampshire QSO Party, sponsored by the NH ARA, will take place on Feb. 12th from 1900 UTC-0700 UTC; Feb. 13th, from 1400 UTC-0200 UTC Feb. 14th. Open to all classes. Techs w/o HF priviledges are invited to join on simplex above 50 MHz. Operating frequencies: CW—1810, 3535, 7035, 14035, 21035, 28035. SSB—1875, 3935, 7235, 14280, 21380, 28320, 50115, 144205. FM—29.610, 52.540, 146.550, 223.500, 446.000, 902.100, 1296.100. There will be a 75 meter phone finale Sun. on 3950 +/- QRM. Logs must be postmarked by March 31, 1994. Contact *Conrad Ekstrom WB1GXM, P.O. Box 1076, Claremont NH 03743-1076.* Please send SASE.

FEB 18-20

MARQUETTE, MI The Hiawatha ARA will operate N8GBA 1700Z Feb. 18th-1700Z Feb. 20th, to honor the Up 200 Sled Dog Championship. The Lower end of the 10, 15, 20 and 40 meter phone bands will be used. For a certificate, send a large SASE with 2 stamps to *Richard Schwenke N8GBA, 21 Smith Lane, Marquette MI 49855.*

FEB 19-20

MOUNT VERNON, VA The Mount Vernon ARC will operate Station N4BV during the hours of 1600Z-2000Z on 19-20 Feb., to commemorate George Washington's birthday. Operations will take place from George Washington's home. Frequencies: The lower General 80m-15m subbands, and on the Novice 10m subband. For a certificate, send QSL with a 9x10 #10 SASE to *Steve Schneider WB4EEA, 8602 Cushman Place, Alexandria VA 22308.*

Never Say Die

Continued from page 4

cently evolved system they've found a much more primitive analog communications system which is still with us. This involves communications about damage to the body and operates on micro-currents. It's a fascinating detective mystery, where Becker has dug out past research data which didn't make sense at the time and put the puzzle together.

Then he gets into how all life has evolved in the Earth's magnetic field and how magnetic fields influence every cell. The micropulsations in the Earth's magnetic field are strongest at 10 Hz, the frequency at which many ol our brain functions occur. Becker shows how electromagnetic energy systems within the body control growth and healing, regulate the level of activity ot the brain, and produce vitally important biological cycles by deriving timing information from the natural electromagnetic environment of the Earth. He shows that there Is a relationship between the Earth's geomagnetic field and human behavior. Further, it's been shown that lhe conscious mind can control the level of activity in the body's DC control systems. This helps with our understanding of how changes can be brought about by the use of visualization, hypnosis, meditation, biofeedback, suggestion, placebo, and religious experiences.

Some yogis are good at this, but more research is needed before the rest of us will be able to use this enormous power. Il the placebo effect could be bottled it would be worth billions. Placebos have been shown to be able to work in 60% of clinical cases, so we're not talking chopped liver.

How do healers work? It isn't the placebo effect, because they're able to be as successful with animals as people. So what then? And how can those super-diluted homeopathic remedies possibly work? Scientific orthodoxy says it's impossible, so the scientists get all upset every time a double-blind research project shows success. It's impossible, so they don't want to even know about it. They argue that there must be some fault in the research. But then other labs come along and report the same findings.

We're dealing with extremely sensitive biological chemical and electromagnetic systems. For instance, a male moth sensing one single molecule of a female pheromone will fly toward her. This process involves the transfer of but a single electronl

Zapping Drug Addictions

A small voltage stimulation unit is popular lor sports medicine and is even being used by jet-fighter pilots to prevent backache from their cramped cockpits. Another has been amazingly successful in helping people cure drug habits—without withdrawal symptoms. Further, the people had a personality change from an addictive to a non-addictive type.

Then there's the use ol small voltages and magnetic fields to help bones mend. These same currents can cause cancer cells to have explosive growth. In 1880 a doctor reported that a patient with cancer of the lip and chin had been struck by lightning and his cancers disappeared within a few weeks, nor did they return during the following 10 years. That treatment is a little rough, so perhaps it's time to see just what it does take. Becker reports on the recent research in this field, showing that even at very low power, microwave energy can have a number of extremely undesirable effects.

How about the Amazon Indians who treat snakebite by touching it with a wire from the spark plug of an outboard motor, giving it a low-current, high-voltage zap? This seems to inactivate the toxin. Otherwise-fatal bites are survivable with this technique.

Becker shows how solar flares affect the Earth's magnetic field and how this correlates with mental hospital admissions. He wonders if it is just a coincidence that past species extinctions coincided with gravity field reversals.

Then he gets into man-made fields and their effect on all life—including us. Doctors in Houston found that the children of fathers who'd been exposed to electromagnetic fields (EMFs) at work had an increased risk of having children with brain cancer before the age of two. Exposure to microwaves and any other man-made electromagnetic fields (such as 60 Hz) produces stress, a decline in the immune system, and changes in the genetic system (none beneficial).

Can Our PL Tones Cause Genetic Changes?

The body is quite capable of demodulating radio signals of any frequency and the biological effect is the same as those produced by low frequencies—just in case you haven't been concerned about what those handie-talkie PL tones may be doing to you. Becker quotes one of the leading researchers in this field, Ross Adey K6UI.

There is a good reason to suspect that the virtual explosion of cancer in the last two decades may be due to EMFs. Since 1975 lymphoma, myeloma, and melanoma have increased by 100%, breast cancer by 31%, testicular cancers by 97%, kidney cancer by 142%, colon cancer by 63%, and so on. Is that enough to make someone think?

Work Is just starting in the extremely low frequency (ELF) field. It turns out that the brain Is extraordinarily sensitive to very low levels of ELF. The government has discounted the emerging research reports because they simply can't be true.

We're using nuclear magnetic resonance (NMR) units in hundreds of hospitals, yet yeast cells exposed to NMR multiply at twice their normal rate and their offspring are half as large as normal!

We know that all substances are magnetic to some extent, because the spin of the electrons around the nucleus produces a magnetic field. Some people are so sensitive to magnetic fields that just being near a TV or computer terminal causes their skin to turn red and brings on flu-like symptoms. Are the rest of us totally immune? Not bloody likely.

The power companies, appliance manufacturers, broadcast stations, and the military have enormous vested interests in the public not finding out about how their fields are affecting us. Scientists who have persisted in publicly raising the issue of harmful effects from any portion of the magnetic spectrum have been discredited and their research grants taken away. Paul Brodeur's books on the subject have documented this, even citing how much some named scientists were paid by the power companies to testify on their behalf when questions were raised. It almost reminds one of the tobacco and asbestos denials.

I think you'll enjoy the book. It's written so you won't have any problem understanding it and it goes into a lot of fascinating detail. I don't think you'll allow any family member to use an electric blanket again, and you may decide to move your linear amplifier across the room where it isn't as close to where you operate.

Now do you see why I found this book so interesting and am trying to get you to read it? It will open a whole new world for you—starting you looking for more information and perhaps even getting you interested in doing some research yourself.

Next I want to review a book by T. Srinivasan, an interesting chap I met recently at a Subtle Energies Conference in Monterey. This is a collection of 28 papers presented at the 1987 Energy Medicine Conference in Madras, India. I'm encouraging Srini to bring out a new edition, but with the material presented in a more reader-friendly form. Scientific papers are usually very difficult to follow, and it's a shame for this important material to be buried for the lack of a simple English translation.

Then there's *The Secret Life of Plants*, by Tomkins and Bird, which raises a whole bunch more questions. And have you read *Electromagnetic Man* by Smith and Best yet? Tsk! Your mind isn't much good to you if you don't give it data to work with, and that garbage on TV you've probably been wasting your time on doesn't count for much as data. We'll have a lot more to talk about on the air if you've read some books. Then you won't have to depend on ignorance to guide you, like the two hams I cited.

A Cure for AIDS?

The way the Lambda homosexual ham club has been spitting in my face, so to speak, and apparently doing their best to hurt *73* ad sales, I've had a short wrestling match with myself over this HIV virus thing. They're mad at me because a militant opportunist in their group has latched onto a flimsy pretext to bring what I consider a frivolous suit against the ARRL for refusing to run their ads in *QST*, and I'm vigorously opposed to bringing lawyers and lawsuits into ham doings. The last I heard, magazine publishers are permitted to refuse any ads for any reasons, stated or unstated.

Now, I'm not suggesting for one minute that all homosexuals are pedophiles, but we've had more than enough of them preying on young hams and the children of hams without opening the door further. Indeed, two very well-known hams have been arrested and convicted of this. Well, enough of my grousing about child molestation. I'd probably shut up if Mike Kelly, the strident voice of Lambda, would stop doing his best to give me free publicity for my opposition to his stupid lawsuits.

Yes, I've said and written that I consider any ham scum who resorts to lawsuits in our hobby. This is supposed to be a hobby, and it's supposed to be fun. When hams get so wrapped up in the hobby that they start lawsuits, their perspective is awack. Kelly can unscum himself, at least to my satisfaction, by dropping the Lambda lawsuit against the ARRL and reimbursing the League for the money (our money, by the way—money that comes from our membership dues) that he's wasted for us with his push to get his homosexual ads in *QST* and, of course, personal promotion for himself.

Now, about AIDS which, if you've read much about it, is almost totally a homosexual problem. The good news is that there seems to be a simple cure for lhe HIV virus. The even better news is that we hams are in a wonderful position to help. I'm not sure why news of this incredible breakthrough hasn't been a cover feature on *Time* and *Newsweek*, but I expect it will be, once a few journalists finally realize what's been jusl recently discovered.

I've an advantage in this case because of my Interest in the research into the effects of low level electromagnetic, radio, and electric fields on cells, and their connection to cancer and a wide variety of other illnesses. Then there's the amazing research which has been done by Robert Becker In *Cross Currents*. He explains how currents in the microampere range can have powerful effects on cells.

Having recent read *Energy Medicine* and *Vibrational Medicine*, I was not surprised to read that some researchers at the Albert Einstein School of Medicine in New York have discovered that a current of about 50 microamperes can alter the outer protein layers of the HIV virus and thus prevent its subsequent attachment to receptor sites. This was reported in *Science News*, March 1991, page 207. Well, if you've done any reading at all In molecular biology, you know this is the breakthrough we need to start getting rid ot HIV.

In my review of *Cross Currents* I mentioned that Amazonian Indians have been able to detoxify deadly snake bites by zapping the bite with a wire from their outboard motor spark plug. The HIV virus can be similarly zapped and the equipment needed to do this is something any ham should be able to build.

Further, if you've been paying atten-

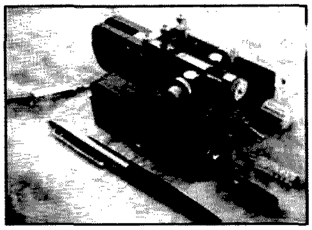
Continued on page 87.

Number 23 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

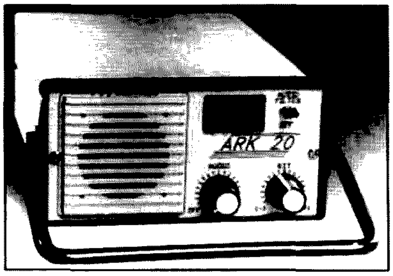
G4ZPY PADDLE KEYS INTERNATIONAL



The first commercially produced single-lever combo keyer has been introduced by G4ZPY Paddle Keys International. This new beauty has a little something extra—if you get tired of using the single lever and want to switch over to a twin lever, there is a jack socket fitted to enable another keyer to use the same iambic electronic keyer.

The new combo may be purchased in four different finishes, and all are fitted with keydown switches. This brings the G4ZPY collection to 50 keyers—the largest selection in the world!

All keyers are handcrafted, so they take longer to produce. For more information, send an SASE (UK) or two IRCs to *G4ZPY, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs., England L40 7TG; Tel/Fax 44 (0) 704 894299.* Or circle Reader Service No. 201.



S & S ENGINEERING

The newest in the ARK Series of synthesized QRP transceivers, the ARK 20, is a rugged unit perfect for Field Day, DXpeditions, camping trips, business trips, or the home shack. Lightweight and portable, the unit measures 2-3/4" x 5-1/2" x 8", weighs less than four pounds, and comes with a tilt-up handle-bail.

The transceiver covers the CW portion of the 20 meter band and tunes in 100 Hz steps. RIT and a 200-Hz-wide audio filter are also selectable from the front panel.

The kit is complete with all parts, silk-screened front and rear panels, and an extruded, anodized aluminum case. The transceiver operates from 11 to 13.8 VDC and provides 3 to 4 watts of RF power. The output power is adjustable to the milliwatt level. Breadboard area on the transceiver PCB makes adding your own favorite optional circuits easy.

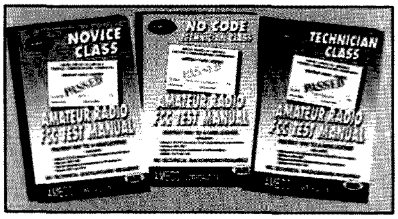
The ARK 20 kit price is $269.95. For more information or to order contact *S & S Engineering, 14102 Brown road, Smithsburg, MD 21783; (301) 416-0661.* Or circle Reader Service No. 204.

AMECO CORPORATION

All the latest changes in FCC amateur radio test preparation requirements are incorporated into the new, revised editions of Ameco's popular license manuals. Separate manuals are available for the Novice Class (Cat. #27-01), the Technician Class (Cat. #28-01), and the new No-Code Technician Class (Cat. #78-01).

Each book covers all the FCC examination questions for each class, with corresponding multiple-choice answers. There is a clear, concise explanation for each correct answer, which helps the reader fully understand the theory and concept behind the question. All questions and answers are conveniently arranged to minimize flipping pages.

These books are by Mr. Martin Schwartz, who has over 40 years experience writing amateur radio license instruction materials. You can purchase the Ameco books from your local ham radio dealer, or contact *Ameco Corporation, 224 East Second Street, Mineola, NY 11501; (516) 741-5030, Fax (516) 741-5031. Or circle Reader Service No. 206.*



OPTOELECTRONICS

A new low-cost communications decoder with advanced features has been announced by Optoelectronics. The Model DC440 reads 50 subaudible (CTCSS) tones, 106 digital (DCS) codes, and 16 touch-tone (DTMF) characters simultaneously! Applications include: two-way communications testing, repeater monitoring, and security and surveillance monitoring. It can also be used to update older service monitors and to enhance recreational monitoring.

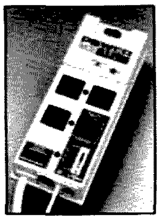
The DC440 displays decoded information on a two-line alphanumeric liquid crystal display. Unique to the DC440 is the serial data jack that permits connection to a PC serial port using the model CX12 RS-232C interface. There is a complete set of control codes to permit remote operation from a PC. Optional NiCd batteries provide up to five hours of portable operation.

The price for the DC440 is $259. For product assistance, further information, or to order, contact *Optoelectronics Inc., 5821 NE 14th Avenue, Ft. Lauderdale, FL 33334; (800) 327-5912, Fax (305) 771-2052.* Or circle Reader Service No. 202.

TRIPP LITE

Tripp Lite has introduced a new product that is perfect for ham shacks equipped with PCs and PC clones. The new Power Miser combination screen monitor and surge suppressor saves electricity by automatically turning off power-hungry computer monitors. Keyboard activity instantly restores the monitor to its prior screen.

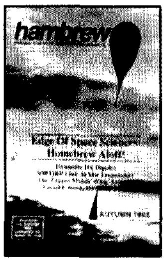
The Power Miser is also a high-quality four-outlet surge suppressor with superior spike and noise line filtering for connected equipment. It provides 720 joules of surge suppression and excellent RFI and EMI noise rejection.



The Power Miser has a retail price of $99.95 and can provide savings of up to $190 a year. For further information contact *Tripp Lite, 500 N. Orleans, Chicago, IL 60610-4188; (312) 329-1777, Fax (312) 644-6505.* Or circle Reader Service No. 203.

HAMBREW

Hambrew, a new magazine devoted to amateur radio builders and designers, is now being published quarterly for hams around the world. The focus ranges from beginner-level kit building to more advanced RF design, with some theory sprinkled in. Articles in the inaugural Autumn 1993 issue included a Ramsey 30 meter transmitter review, constructing foam-core panel cases and cabinets, the NorthWest QRP 30-30 Transmitter, and decoupling loops for dipoles with a discussion of counterpoise.



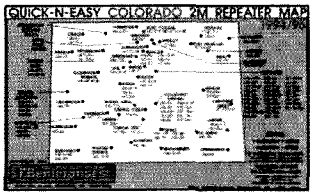
Classified ads are free to both commercial and non-commercial subscribers. Subscriptions are $20/yr. domestic, $30/yr. Canada and Mexico, and $35/yr. elsewhere. For more information contact *Hambrew, P.O. Box 260083, Lakewood, CO 80226-0083; (800) 5-HAMRIG.* Or circle Reader Service No. 205.

FB ENTERPRISES

FB Enterprises is now offering the 1994/95 edition of their popular "Repeater Maps." These maps are available for all US states, Canadian provinces, Central American countries, and Caribbean islands. (California is split into Northern and Southern California, so please specify when ordering.)

The updated maps show 2 meter repeaters in full color on the front of the card, and the bands between 220 MHz and 1.2 GHz are in black and white on the back. They include autopatch information and CTCSS tones for those repeaters which use them.

The maps are 5-1/2" X 8-1/2" and are laminated in clear plastic. They retail for $3.95 and are available at your ham radio dealer or directly by mail order. Catalogs are available for $2 (refunded with purchase). For more information contact *FB Enterprises, 23801 NW 1st Ave., Ridgefield, WA 98642-8830; Voice/FAX (800) 377-2339.* Or circle Reader Service No. 207.



MICRO-OHM MEASUREMENTS

Micro-Ohm Measurements has announced the new Ohm Extender—a device that will give your DMM a new depth of operation. The Ohm Extender is a portable battery-operated adjunct, which uses your digital multimeter as a readout.

The Ohm Extender gives you the equivalent of an expensive milli- and micro-ohm meter, which would cost 10 times as much. You can actually measure shunt resistors; precisely measure wire length; verify circuit board trace resistance; read motor, transformer, and choke values; and check switch and relay contacts.

All components are of the finest quality and there is a one-year limited warranty. The price is $161 ppd. For more information contact *Micro-Ohm Measurements, P.O. Box 460, Brookshire, Texas 77423; (713) 934-4659.* Or circle Reader Service No. 208.

NEVER SAY DIE

Continued from page 85

tion to the news, you know that some German blood banks have been careless and allowed HIV virus to get into their supplies. Now we know how to easily and quickly cleanse any blood of the virus.

A physicist friend of mine gave a lecture on this new procedure to a group of doctors at a recent symposium and they gave him a standing ovation. But I suspect the pharmaceutical companies are going to be extremely upset over this development. There are no drugs involved. The drug companies have been investing millions in search of a magic drug to counter HIV—and have gotten nowhere. It's probably fitting, in a way, that the solution to this scourge can be cured by some electronic equipment which costs well under $100 to make. Simple stuff.

The normal medical electronic industry approach would be to put the simple circuits involved into an impressive box, add a bunch of meters, and charge $10,000. And it would be worth it. The fact is that there's nothing more required than parts you can get at almost any radio parts store.

What about side effects? There aren't any. As far as I can see, this approach should be able to eliminate the HIV virus within a few days for anyone infected with a simple and completely non-invasive treatment. Of course, since the equipment involved is not FDA approved, you can't make it and sell it to doctors. If they bought it, they wouldn't be allowed to use it. But you are allowed to experiment with it, even on friends. And doctors are allowed to do research with it, as long as they've built the equipment themselves. Thus there is going to be one heck of a market for Heathkit-like kits for experimenters and doctors.

There are two pieces of equipment involved. One passes a microampere current through the vascular system, cleaning out the HIV virus in the blood. The other generates a short and very powerful magnetic field to flush the virus out of the lymph glands, where it tends to hide, and into the vascular system, where it can then be eliminated.

If you've done any homework on how cells work and the effects of microcurrents on them, you'll understand the beauty of this approach—and why researchers have failed to discover it for so long. The labs, largely funded by pharmaceutical companies, have been looking for a chemical cure—one they can sell. There's been little funding for nontraditional approaches. Indeed, the orthodox scientific community routinely suppresses research like this and does its best to cut off all possible funding sources. In this case all it took was one non-traditional physicist to see the implications of the Albert Einstein College discovery and develop the hardware needed. He used to be a ham, but got so involved with research that he let his license lapse.

What happens is that when a small current flows through the vascular system it hits the HIV virus and causes it to lose its ability to make an enzyme crucial to its reproduction. Then the white cells can no longer clump together, and the virus is terminated. Using this approach it will also be simple to quickly cleanse infected blood banks, thus preventing further HIV infections from transfusions.

If there is any real *73* reader interest in this I'll consider printing the circuit diagrams of the two simple units, along with detailed instructions on their use. If I get less than a thousand requests, I won't bother. I certainly don't want to take up valuable space in *73* for non-ham-oriented construction articles that not many readers want to read about. That wouldn't be fair to the other readers. Mind you, if I do print the construction plans, I'm not making any medical claims. I don't need to have the FDA or any other government agents making my life miserable. Anything you build is completely between you and yourself. And anything you do with it is strictly experimental. I'm just a journalist reporting what I've heard and read.

Experimenters have shown that it takes about three weeks, using the equipment a few minutes a day, for a complete HIV remission.

Will we be seeing headlines about this? Eventually, but you read it here first.

So what's next? How about a simple electronic approach to drug addictions? Any interest? No, probably not. I expect I'll get the usual letters asking me to stop writing about stuff like this and stick to ham radio topics in a ham radio magazine. Like *QST* does. But yes, there is good reason to believe that another fairly easily-built piece of electronic equipment could zap even the most vicious of drug habits.

Religious fanatics may be upset with me over all this. I've talked with several on the air who are absolutely convinced that AIDS has been sent as a curse by God as retribution for the homosexual lifestyle. Unfortunately they haven't convinced me that their pipeline to God is any better than mine. And I wonder how much Kelly is considering the rights of homophobes as he pursues his own demons and his personal quest for power via gay militancy.

It doesn't seem to have occurred to Kelly that anyone who is not stridently pushing for gay rights can be anything but a homophobe. Go back into the closet, Kelly, and shut the padded door behind you.

Ordering Books and CDs

[Editor's Note: Wayne often references books and CDs in his editorials. The books are often available from Uncle Wayne's Bookshelf; the CDs from IMPS by Mail. Both can be ordered by telephoning (800) 234-8458 or (603) 924-4196, or by faxing (603) 924-8613.]

Number 24 on your Feedback card

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DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '92 issue must be in our hands by February 1st. Mail to *73 Amateur Radio Today*, 70 Rte. 202 N. Peterborough, NH 03458.

Number 25 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

This month is considered an "in-between" month and exhibits some winter and some spring "conditions" on the HF bands. Although 1994 will be a year of fewer sunspots than the past eight or nine years, it will still permit excellent DX propagation on the days marked "G" on the calendar but, as usual, this will depend on the band you choose. Winter conditions of low noise and good night-time propagation on 80 and 160 meters will continue this month, but atmospheric noise will increase as the equinox in late March approaches. The *poorest* days for DX are likely to be those surrounding the 8th and 21st of the month. The *best* days for DX will likely be those marked with a "G" (Good) and "F" (Fair), or trending between F and G. On the Poor days keep an eye on other geophysical conditions, such as storms and high winds with much snow in the north and rain or sleet in the south. Geological disturbances are more likely on or near the "P" days, if they appear at all. Stations with better antennas and receivers are likely to fare better in times of low sunspot activity as the maximum useful frequencies also decline, and hours of good DX are shorter than ever. Some F2 openings may last for only an hour or so on the 10 and 12 meter bands as the MUF rises above 28 MHz. Choose the "G" days for *your* best opportunities. Short skip will prevail on the days these bands are open.

On the *15 and 17 meter bands*, you may find DX opportunities quite good with afternoon (local time) hours being better than morning hours, and short skip should continue during most daylight hours, but the band will close around dark.

The *20 meter band* is always our most reliable DX band, and is even more so during times of low solar activity. Peak conditions occur shortly after sunrise, and again in the late afternoon, and should provide the best signals to distant locations. Short skip will prevail during daylight hours out to about 2,000 miles or so. North-south paths will open shortly after dark, as well, with excellent propagation on Good days.

The *30 meter band* exhibits some of the behavior of 20 and 40 meters. You can work DX on many days around sunrise and sunset, with short skip prevailing during daylight hours. Although the band "dies" an hour or two after local sunset, these hours may be the very best for DX and grey-line propagation along the day/dark terminator.

The *40 meter band* tends to "peak" for DX toward Europe and Africa in the late afternoon and early evening, and toward the Pacific in the morning around sunrise. This band will stay open long after dark for short skip, which usually prevails during daylight hours.

The *80 meter band* may be your best lower HF band for DX between sunset and sunrise, peaking around midnight (local time) and again around sunrise. Noise levels should remain low until late in the month when springtime storms occur more frequently. Short-skip conditions at night will open out to 2,000 miles or so.

The *160 meter band* will not be open during daytime, but will be very good after dark, and DX ought to peak around midnight local time. Short skip at night during early evening hours will be quite good out to 1,500 miles or so. Look for DX also around, or just before, local sunrise, toward the west, south and other directions. 73

EASTERN UNITED STATES TO:

GMT.	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
AGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U.S.S.R.		40						15	15	20		
WESTCOAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

GMT.	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U.S.S.R		40	40					15	15	20		

WESTERN UNITED STATES TO:

GMT.	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U.S.S.R								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A=Next higher frequency may also be used.

FEBRUARY 1994

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G-F	2 G-F	3 G-F	4 G-F	5 F
6 F-P	7 P	8 P	9 P	10 F-G	11 G-F	12 F-P
13 P	14 P-F	15 F	16 F-G	17 G	18 G	19 G-F
20 F-P	21 P	22 P-F	23 F-G	24 G	25 G-F	26 F
27 F-G	28 G					

Number 27 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Enough!

Polly Klaas was a beautiful 12-year-old girl. Last year, on October 1, she was having a slumber party with a few of her friends. Her mother slept downstairs while the girls stayed up and discussed things of monumental importance to 12-year-old girls. A knife-wielding thug broke into the house, tied up the girls, took Polly and left.

Despite a monumental publicity and search effort by the citizens of Polly's home town, this beautiful little girl's body was found two months later. The man who murdered her had been confronted by police twice during those two months, the first being less than two hours after the kidnapping. He has a record of arrests and convictions for abductions and other violent crimes going back almost 20 years. He has served time in prison for these crimes, and yet he was free to walk the streets of California just like you and me.

In the last two weeks, authorities in St. Louis have had to inform two sets of parents that their children won't be coming home—ever. They were both little girls. One was 9 and the other was 10.

If you live in a small, rural community, and you think this kind of heinous crime can't happen to you—think again. Ten days after Polly Klaas disappeared, Stephanie Crane was abducted from her small Idaho town—population 700.

Are you mad yet? Have you had enough of this? Are you going to continue to allow the scum of our society to get away with this? Are you going to continue to elect local, state and federal politicians who are afraid to make the hard choices of taking away the rights of convicted criminals in order to protect the rights and lives of the law-abiding? How many more beautiful 12-year-old girls are going to have to die horrible and lonely deaths before the people of America wake up and demand a criminal justice system that deals with crime and the punishing of criminals? Over 500 children were abducted last year, and that's 500 more than we should tolerate. Today, as you read this, another child is being taken—another child that we'll never find. I gotta' tell ya' folks. I am beside myself with anger over this. I can barely type these words. I have had enough.

Amateur Radio *Can* Be Part of the Solution

The common response to this type of situation is: "What can *I* possibly do?" Aside from electing people carefully and supporting spending for more cops, bigger prisons, longer sentences and abolishing the parole system, what *can* the average person do?

We may not feel like we have control over courts, prisons and parole boards, but we *can* do something. We can say enough is enough. We can say that the next time a child turns up missing we will be prepared. Not prepared to help tomorrow or next week —we can be prepared to help *right now.*

When a small plane crashes (or is only *thought* to have crashed), there are systems and volunteer organizations in place to search for and come to the aid of the crash victims. As a Private Pilot I am thankful to always know that should the unthinkable happen, I won't be left to die on the craggy slopes of a windswept New Hampshire mountain because there wasn't a system in place to come find me. Within hours of my late arrival there will be dozens of people and aircraft searching for me.

"Over 500 children were abducted last year, and that's 500 more than we should tolerate."

Couldn't we do the same for the children of America, and isn't the amateur radio community ideally suited to form the core of such a system?

Even with the best efforts of law enforcement, it can be several hours between the time a parent reports a missing child and when any kind of an organized search begins. Think about it. It's six o'clock. You just got home from work, and your 12-year-old isn't there. He was supposed to be home after school, by three o'clock at the latest. You call your neighbors, and they haven't seen him. You call his school friends, but none of them know where he is. You call the police, and they send someone out to your house to ask some questions, while alerting their patrol officers of a *possible* missing child. You provide police with a description and a picture. While talking with the police officer, you remember the name of another of your child's friends. You call and he tells you that he saw your son get into a blue car driven by a tall man with a beard. This information is immediately transmitted to local law enforcement. What time is it now? How long has your child been missing? How far away could the kidnapper have traveled in that amount of time?

Over the next few days, volunteer search teams are set up. Posters are distributed over an ever-widening area. The FBI gets involved, as do several of the national organizations set up to assist in finding children. How many days go by? How many nights? Will you ever see your child again?

What would have happened to Polly Klaas if, within an hour of the local police department's call to an amateur radio search coordinator, there were several dozen *trained* hams searching in an ever-widening pattern, all coordinated with a net control station at the police department? What if another dozen teams were searching in automobiles, checking all available modes of escape out of the area, driving the roads and stopping at stores and gas stations and asking questions? What if the eyewitness's description of the kidnapper was transmitted via packet to the local search teams in surrounding communitites or neighboring states, not days but minutes after it was available? What if all of this happened within one hour of the initial call to local police?

It doesn't matter if the child is *really* missing, or if he just went somewhere without telling his parents. Every second of doubt is an eternity of anguish for parents who don't know where their child is. How would you feel if you were the ham who could transmit to net control, "I found him. He's OK."?

I'm not talking about a bunch of fat guys with HTs on their belts and a Rambo complex. I'm talking about an organization that sets up systems with the aid and backing of local and national law enforcement agencies *before* they are needed. I'm talking about a national organization, with state and local chapters, that continuously trains and prepares for the day when they have to—within 60 minutes—mobilize to search for a missing child with the same thoroughness of the Civil Air Patrol's search for a missing pilot.

Amateur Radio Child Search

I propose the founding of an organization called Amateur Radio Child Search (ARCS). To assist in getting this started, Wayne Green has pledged the financial and logistical support of *73* and the entire Wayne Green, Incorporated organization. I am looking for amateur radio operators in all 50 states to assist in developing this organization. I will listen to anyone and everyone who is willing to help (I'm not saying that I'll take your advice, just that I'll listen to it). I mean it. I would welcome the participation of the ARRL or any other amateur radio company or group. This is above the petty squabblings of amateur radio (and amateur radio magazines). This is above your animosity towards Wayne Green, me or *73* magazine. I am looking for funding avenues to aid in forming this national organization. If you have experience in areas such as grant writing, your help would be most welcome. If you are already involved in search and rescue, whether professionally or as a volunteer, I'd like to hear from you.

The plan is to have local groups in every state, all coordinated by a national organization, to assist law enforcement in the immediate search for missing children. If you're a paramilitary, soldier of fortune, cop wanna-be type of nut, please do me a favor and stay away. We're not talking about chasing bad guys. All we want to do is find missing kids.

The state coordinators, all selected by the national office, will oversee the operation and training of their local team leaders. Team leaders, selected by state coordinators with the approval of the national office, will be responsible for the training of their local chapter, as well as building and maintaining relationships with local law enforcement agencies. Chapter members will be responsible for staying current in their training and being available to assist in the search for a missing child *within one hour* of notification. Everyone involved in this organization will be screened and registered by the national office.

Amateur radio desperately needs to justify its existence. We no longer advance the state of the art, we are not needed as a trained pool of qualified radio operators, and there ain't a whole helluva lot of international goodwill generated by the average DX contact. How about if we decided that one of the reasons for our existence should be to use our communications skills and networks to come to the aid of missing children? There are well over 250,000 *active* amateur radio operators in this country. Could the combined efforts of a quarter million people, united for the single purpose of protecting the lives of our children, make a difference? Is there any more important use of our time and talents?

I may be setting myself up for a big disapointment by announcing this before the logistics are worked out, but if there is one thing I have learned from Wayne Green in the last four years it's that the only way to get someting done is to just do it. Talking about it doesn't get it done. It will take several months to find out if starting an organization such as I've described is even possible. I'll be meeting with attorneys and accountants to set up the paperwork. I need the help of every interested person. If nothing else, send me your name, address and phone number so I can put you on the list for when your state and local chapter gets started. If you can do more, let me know that too.

Inquiries should be sent to my attention at *73 Amateur Radio Today*, 70 Route 202 N, Peterborough, NH 03458.

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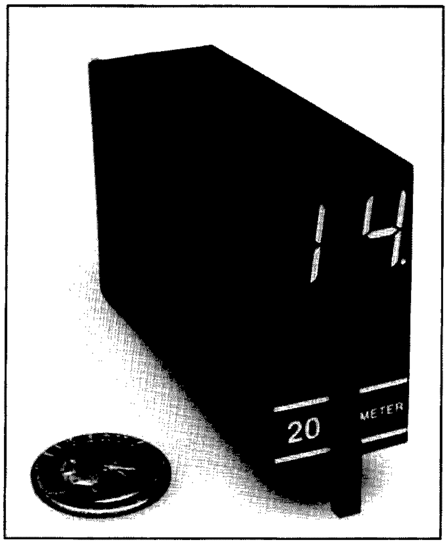

Want to plug in a new band?... See page 36.

DEPARTMENTS

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On the cover: Bring pictures from space right into your home. See "Getting Started With Satellite Imagery" on page 10. Receiver Model R7100 courtesy of ICOM. Satellite image courtesy of MultiFAX. Photo by David Cassidy N1GPH.

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Dayton or Not?

The weekend at Dayton is exciting, with hundreds of indoor and seemingly thousands of flea market exhibits, plus an endless array of special interest sessions. Dayton provides the only practical meeting place for the whole group of hobbies we call amateur radio. It's a place for the pioneers in packet to get together and talk, and to see the latest hardware, software and information products for their niche in the hobby. Ditto those interested in DXing, RTTY, SSTV, ATV, and the almost endless other ham sub-hobbies.

So why would anyone bother to take an hour and a half out of the few hours of the Dayton weekend to sit in a hot room and listen to Wayne Green talk about whatever happens to be on his mind—which usually isn't even about amateur radio?

Last year we stopped having a *73* booth. We looked over the sales vs. costs of having a booth over the last few years and found it just wasn't cost effective anymore. After so many years at Dayton, that was a difficult decision. Lordy, I set up my first booth at Dayton in 1955 and haven't missed many years since then.

But even without a booth I made the HamVention trek, mainly to go around and say hello to my many friends in the industry and to give my Saturday afternoon talk. But I found that my industry friends were so busy dealing with the hams at their booths that they didn't even notice me trying to say hello. They were too busy selling to schmooze.

Since my talks are usually just rehashes of the things I've been writing about in my editorials, I can understand why only about 1% of the attendees bother to sit and sweat while I repeat what they've probably already read.

When I was gung-ho on OSCAR, or helping to pioneer RTTY, repeaters, 50 MHz, SSTV, and so on, I had a good reason to go to Dayton to meet my fellow pioneers. But these days my pioneering interests are in new technologies, in politics, and stuff like that. Stuff you probably don't care about—even though you should.

From my viewpoint there are so many exciting things happening that I don't know where to start and what to do next. There's this cure for AIDS which an ex-ham physicist friend of mine has developed. There's the incredible progress in cold fusion, which looks like it'll be one of the fastest growing new industries in the world. One that will present endless opportunities for entrepreneurs to make fortunes. There's the growing understanding of how bioelectrical systems work, both in plants and animals. There are those pesky problems we're all ignoring, like the deficit, our crooked Congress, crime, guns, drugs, lousy schools, street gangs, taxes, health care, the Morse code, Somalia, government waste, the IRS, FDA, FBI, and an endless other bunch of government acronyms which are screwing us.

You may have plenty of time to sit and look for pileups to jump on, ball games to watch, golf to play, but I'm up to here in books I want to read, stuff I want to write, and new businesses I think are needed.

So what do you think? Is there anything I could talk about at Dayton that would make you want to come and listen? For most of us it's a long and expensive trip to get there, so we want to make every minute count. We want to see all the inside exhibits. We want to haggle the dealers for the best new gear prices. We want to check out the humongous flea market. We want to get together with hams who share our special interests, and Dayton's the only place we can do that.

Please drop me a note or a QSL card and let me know.

Is Artificial Light Making You Sick?

The odds, oddly enough, are that your home, hamshack, and office are helping to make you sick, and not any way you'd probably guess. No, I'm not talking about the electro-magnetic field from your electric blanket, or your linear amplifier, though they're certainly bad enough.

One of the books I came across at the recent Tesla Society science conference in Colorado Springs is a corker. I'll try to have it available for you through Uncle Wayne's Bookshelf. It's *Light, Medicine of the Future*, by Jacob Liberman. Light? Good grief, what's Wayne found now?

OK, before I get into a review of the book, follow me on this. Unless you've been intellectually stunted by religious fundamentalism or watching too many stupid sitcoms, you're aware that evolution, over millions of years, has resulted in we humans. And that means that we've been designed to operate within the parameters of our world. Thus we find, when we send people into space, that their bodies don't do well at all. We're designed to operate with one G of gravity. Further, we've evolved in a world with a strong permanent magnetic field—one which changes continuously as a result of varying radiation from the sun and the influence of the moon. We're also being impacted by solar radiation, including light, as well as a wide range of other frequencies from the infrared up through the ultraviolet and cosmic rays. The light from the sun has a spectrum that we've evolved in which is important to us. You take that away, or even change it a little, and there's hell to pay. Indeed, we're paying for it with sickness and bad dispositions.

There's even strong evidence that one of the factors contributing to the demise of the dinosaurs was the reversal of the Earth's magnetic field.

Now, scientists have been experimenting with light and their findings are scary. Maybe Edison didn't do us as much of a favor as we thought. It's turning out that we are a lot more dependent on sunlight that we've suspected. One of the more damaging things we've done to our health is invent glass and, in particular, sunglasses. Another is to invent artificial lighting which doesn't give us nearly the same light spectrum as the sun.

So here we are living and working in fluorescent and incandescent light, and it looks as if we're suffering a wide variety of illnesses as a result. The human immune system, given a decent break, is able beat almost any germ, virus or even carcinogen. But we've been crippling our immune system in a number of ways—and a big one is via cutting off the light spectrum our eyes and bodies need—the light our eyes and bodies have been designed to use and are dependent upon through thousands of generations of evolution.

A small group of researchers has been testing different colors of lights on plants, animals, and lately on humans. You can set up your own experiments at home and see for yourself what happens to growing things when they are deprived of sunlight. It's simple. All it takes are some beans or other seeds and patience. Grow some in the sun—and I don't mean behind a glass window. Grow others with the sun they get through a glass window. Try some under different colors of fluorescent lamps. Try some with the full-spectrum fluorescent lamps. And don't forget to find out what happens when you use incandescent lamps.

This whole business got started when a chap named Ott got involved with the stop-motion photography of plants. He had to light them properly and keep them in a closed box so they wouldn't be disturbed by the wind. Well, he sure ran into all kinds of problems. The darned things refused to grow right. He eventually discovered it had to do with the light he was using. Hmm, if light makes that much difference for plants, what about animals? He went on to test different light colors with mice and rats, and then larger animals. It turned out to make an incredible difference in their growth and dispositions. I can't give you all the details here, but you'll find his story most fascinating. It's all in the book, *Health and Light* by John Ott (1973-$10).

Ott's pioneering work has been carried on by Liberman. In his book you'll read about some amazing cancer cures just with sunlight, the curing of a wide variety of illnesses, of hyperactivity in kids, and so on. You'll read about how introducing the sunlight spectrum of fluorescent light bulbs can completely change the way people work in offices and factories, and even the way classrooms work. You'll also read about the efforts of a small group of scientists who have been fighting our scientific system for years, trying to get their work published and recognized.

Scientific research is a big business, with a third of the research funds coming from the government. The fund allotments lie mainly in the hands of a few businessmen who are very careful not to upset any established businesses. But the problems we have with our scientific research system is a real shame. I've been reading some excellent books on this. The bottom line is that there are a whole bunch of fields that science should explore, but which those controlling the money refuse to acknowledge. I'll review the exposé book, *Impure Science* by Robert Bell, a 1992 book, for you on this topic. What's happening is a disgrace.

So start growing some beans and see for yourself what an amazing influence the sun's light spectrum has on life. And don't try to tell me that, well, those are plants and we humans are different. The hell we are. When you graduate to growing mice under different colors of light, you'll see that

Continued on page 84

LETTERS

Number 2 on your Feedback card

From The Hamshack

Bruce E. Parkes KA2ZGW, San Antonio TX How is life in the snow bell? Once I finish the next four years in the Air Force I may be joining you in the cold, only a few states to the west. It's too early for me to get the cheap air fares, but then I do enough flying right now to last a lifetime, at least riding in the back.

You asked for product reviews in your December 1993 column, so I thought I'd send you a couple.

Since I travel a lot and still like to participate in amateur radio on the road, I like to try both HF and VHF while in my motel room at night. VHF has been the easiest mode to use. Have you ever tried to hang a 40 meter dipole from the second story of a motel without attracting attention? I've used a few window frames with an antenna tuner with fair results, but 2 meters seems the easiest. Use the *ARRL Repeater Book* to find the locals and kerchunk all the repeaters listed until you find some that you can hit. Calling CQ doesn't do much, so wait until you hear an XYL (or YL) come on frequency. Jump in, and soon you will have all the folks you would like to talk to. I have found that the Radio Shack 2 meter HT is the best rig for the road. I carry it in my helmet bag, which takes a lot of knocks, and it has always done well for me. Having two battery packs increases its utility on the road. The only problem I have with it is the inability to modify it to cover the MARS frequencies. It is a great rig for on-the-road packet and, with an external power supply, it produces an honest 5 watts out.

However, I am not so fond of the ARRL's book *Low Profile Amateur Radio* by Jim Kearman KR1S. I have been operating low profile for years while away from home. The most impressive was during my tour in Panama, which coincided with the problems there that culminated in Operation Just Cause. Since I had a station that wasn't really legal with the local government, I kept it low key. This was an advantage during the war, since I was able to slip away from my duties for a few minutes to keep a schedule with a ham near my home, and relay that I and others from the same area had weathered the initial assault and were well, to my wife, who then passed it on to other families. Unfortunately, I was unable to find any new ideas in the 124 pages. Maybe this book will be of interest to new hams. It didn't do a thing for me.

I liked your certificate from Lambda. After talking with large numbers of hams over the years, I have noticed that what they do in bed has never been a major item of discussion. In fact, I've never discussed it with anyone. Strange that one group wants to throw it up in everyone's face. As a nurse, I have noticed that folks are most defensive about that which they are most uncomfortable with. Are gays that worried about themselves that they must throw their styles in everyone else's face? I hope they get a life.

John Doe I have just started reading your magazine and your "Never Say Die" column hits the nail on the head each month. I just recently passed the No-Code Technician exam and I eagerly await my license.

I have tried on several occasions to learn the code but, for whatever reason, I've not been successful. I joined a local club and one of the first things they did was try to pressure me into learning the code. They just don't understand how someone could be happy with just local communication capability. Let me explain.

My main interests are model railroading and photography. I often go into remote areas to photograph trains, then I use the photos to assist with building models. It finally dawned on me (I'm 36) that some means of communication would be good to have in case I get into trouble. The no-code license fills that need for me. Anyhow, I'm stubborn enough that I'll remain a club member and I'll resist their efforts to get me to learn code, especially when that archaic means of communication seems to be in direct conflict with one of the purposes of the amateur radio service, which is to "advance the radio art."

If you want to incorporate any of this into your column feel free, just change the name and location. I don't need to be ostracized any more than I already am by the local hams.

P.S. The ARRL will never see me as a member until they take a more up-to-date approach.

John—As long as you are able to get your interest piqued by the many other aspects of amateur radio, and are content to use just one very small piece of our hobby, you have no real problem with the code. But if you have no interest in talking with people in other countries, in using the hobby as anything more than an alternate to CB, I wonder why you've bothered to join a ham club.

I've been fighting the ARRL for over 30 years to get rid of the stupid code as a barrier to getting a license. The no-code ticket is a good start. However, I do admit that if a person goes about learning it the best way, it's a small problem. You can learn the code characters in less than an hour. And that's all you need to know to pass the 5 wpm test, as we pointed out in 73 several years ago, much to the consternation of the ARRL. You just write down the dots and dashes and then, at your leisure (their is no time limit for the exam), you decipher them.

But, using my code tapes you can learn the code at 20 wpm within a few days, and it doesn't take any brains to do it . . . just tune our bands to prove that. Total idiots can learn the code. Five-year-old kids learn the code. We've any number of seven-year-old Extra Class hams. Yes, the code test is dumb. But then, one would be hard put to find any area where the government has messed with things that their rules aren't dumb.

I learned the code over 50 years ago and haven't used it more than two or three times. But one of those times did save my life and those of 83 of my shipmates. Another enabled me to make aurora contacts on 2m, which was exciting. The trouble I went to learning the code did pay off for me. But I promote the learning of the code as voluntary, so one can have fun with it . . . Wayne

Jim Gray W1XU, Payson AZ Wayne, your column in the December issue is a corker! My wife, Peggy, and I had many good laughs, and we also enjoyed several items particularly: psynce and subtle energies.

John Nelson, as you well know, pioneered the PSYNCE of planetary alignments in radio propagation. I've followed in his footsteps, but have never been able to find his book on the subject. Consequently, my forecasts (in *73*'s "Propagation" column) are not as elaborate—or as accurate—as I'd like them to be. Perhaps you have his book in your library; if so, I'd like to borrow it from you. When John died, a lot of good information went with him . . . and I'm very interested in learning more. None of the sources I've checked seem to have his book, and most don't even know what I'm talking about. Of course, as we both know, "scientists" are great pooh-poohers of anything that's not dogma and "accepted" knowledge. However, here's a field that ought to attract scientists, but to them it's "astrology" and therefore untouchable. Needless to say, "astrology" uses a geocentric system, whereas Nelson and I used/use a heliocentric system, and the *Astronomical Almanac* as our prime data source.

The well-known "weak forces" of gravity and atomic binding forces are being studied everywhere among REAL scientists, and it's now considered by some that the Heisenberg Principle is factual, and that even looking at an electron or an atom can actually "create" it, and most certainly move it. We can know where an electron is, or when it is, but not both at the same time . . . and many consider an electron field as a "smear" rather than discrete orbital mechanics of individual electrons in "shells" . . . quite different from the Bohr atomic model that you and I learned. It is my view that the weak forces/subtle energies of gravity, electromagnetism, and atomic/nuclear binding forces are all part of PSYNCE. So, what holds our universe together on the micro as well as macro levels is worthy of study. Once, I built an Hieronymous machine according to the diagram and discussion by John W. Campbell in *Astounding Science Fiction* back in 1946. The darned thing worked . . . at least it did for me! Dowsing also works for me, as it does for the street and water departments of many towns and cities. I guess what I'm saying is that the so-called "esoteric sciences or pseudo-sciences" deal with portions of the whole. Just as medicine is now acknowledging a "holistic" approach to human health, it is necessary to adopt a holistic approach to the unified field that may include remote viewing, psychokinesis, dowsing, and other "valid" portions of psy phenomena.

Tom Linde KZØT, Knoxville IA Wayne, thank you for your most marvelous piece in the December 1993 *73*. You speak with a glorious vision about the frontiers that we need to explore as an essential part of our good hobby. Some of those frontiers are in the classroom, some are in the stars, and a few are in resources that we use, and perhaps take too much for granted, daily. I suspect part of the survival of our endangered hobby is making better use of what we already have. The example I submit is the Extra Class subband on 75 meters.

Before I got my Extra I was motivated by the goal of having a classy 2 x 1 callsign, and working people who were more enlightened than those who inhabit other parts of the band. I have a disability with a speech defect, and there were predictable responses whenever I went on the air.

One day a couple of years ago I discovered a very special net in that very hallowed subband of 75. The net accepted me as one of theirs. But far beyond that, it launched me on an adventure that to me was the very essence of ham radio at its best. The net let me explore my limits on 75. Even better, it helped me begin exploring new ways to expand and stretch the limits of that often goofy band. It's a band which challenges us to find ways to make it work better for us. As a net, we do that.

What net is this? It's the Geritol Net, and as a member let me say right off that Geritol is not the greatest acronym. The net operates to help properly licensed hams win their WAS. There is a fine, strong sense of collaboration, a sense of collegiality which is too often missing from our hobby.

Our next newsletter (we publish three a year) will focus on ways to help people who live in the city be more active on our net since we noticed that most of our members have rural or upbeat suburban addresses. But there are lots of cliff dwellers out there. How can we help them expand their horizons?

I think it would be great if you could use some of this information in your column because I think you do wish to push the many horizons which give shape to our hobby.

If by chance you ever tune in to our net—it meets every night on 3.768 MHz at 01:00Z until 50, 6 or 7Z—you might hear me. I do get on a lot because I love adventure and adventure is the essence of this net. My voice stands out because it is the voice of one who has severe cerebral palsy. I have worked all states several times over and I'm also the editor of our newsletter.

Novice Operators Gain Privileges

The Federal Communications Commission in late November decided to grant full 1.25 meter band access to Novices. The FCC declined, however, to adopt proposed rules that would have allowed Novice Class operators to own and operate repeaters in the 1.25 meter and 23 centimeter bands.

In other action, the commission adopted rules to create a small subband from 222.00 to 222.15 MHz for experimental work where repeaters are prohibited. Many experimenters feel weak signal work and repeaters are incompatible because of the lengthy operating time of repeaters. Under the new rules, all other types of communication can continue in this subband. This should allow for more weak signal experimentation.

Effective February 1, 1994, the following replaced the old amateur service rules:

Section 97.201 Auxiliary Station

(b) An auxiliary station may transmit only on the 1.25m and shorter wavelength frequency bands, except the 222-222.15 MHz, 431-433 MHz, and 435-438 MHz segments.

Section 97.205 Repeater Station

(b) A repeater may receive and transmit only on the 10m and shorter wavelength bands except the 28.0-29.5 MHz, 50-51 MHz, 144-144.5 MHz, 145.5-146 MHz, 222-222.15 MHz, 431-433 MHz, and 435-438 MHz segments.

The entry under VHF in Section 97.301 (f) is amended by revising the frequencies authorized for use by Novice Class Operators in ITU Region 2 to read as follows:

Section 97.301 Authorized Frequency Bands

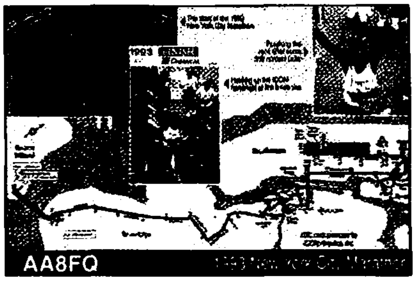
(f) For a station having a control operator holding a Novice Class operator license: VHF 1.25 m wavelength band: 222-225 MHz. Sharing requirements; see Section 97.303 paragraph (a).

More than 100,000 amateurs now hold the Novice Class license. *TNX W5YI Report, Issue #24, December 15, 1993.*

College Bound

The Foundation for Amateur Radio, Inc., a non-profit organization headquartered in Washington, DC, plans to administer 49 scholarships for the 1994-95 academic year to assist radio amateurs. To qualify you must be a licensed ham and you must be enrolled in or accepted for enrollment in a full-time course of studies at an accredited university, college, or technical school.

The awards range from $500 to $2,000, with preference given, in some cases, to residents of certain geographical areas. Additional information and an application form can be requested by letter or QSL card, postmarked prior to April 30, 1994, from: *FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740.*



Go the Distance

Fred Doob AA8FQ is no couch potato. In fact, the 47-year-old ex-smoker likes to mix ham radio with another favorite pastime: running marathons. Fred recently participated In the New York City marathon (see QSL card above) and will attempt to finish the grueling 26.2 mile Los Angeles Marathon on March 6th to help raise money for Children's Cancer Research Fund of Los Angeles.

Fred says he'll be operating his ICOM IC-W21AT HT transceiver equipped with a headset/boom mike while he Is running the race. With the HT strapped to his waist, Fred carries a special PTT switch in his hand in order to complete plenty of QSOs on the four-hour run. In New York, Fred raised $2,500 for the Sloan-Kettering Cancer Center and logged more than 300 contacts. As with the NY event, ICOM will contribute $5 to cancer research for every QSO.

You can help Fred go the distance in helping kids with cancer by sending a contribution to CCRF, c/o Fred Doob, P.O. Box 20100, Shaker Heights OH 44120.

Custom Callsigns

In December, the FCC proposed giving amateurs the ability to choose their own callsigns, once a new automated processing system has been implemented at the Commission's Private Radio Bureau. Under the so-called "vanity callsign" proposal, hams would be required to file a form and pay a fee to apply for an available callsign.

The FCC said that callsign selection by new hams was not yet feasible, but left that issue open for possible future discussion. The new automated system may eventually allow for individuals to check on the availability of callsigns and for electronic filing of license applications.

Trustees of club and military recreation stations would also be eligible for the new program. An earlier rule establishing a callsign administrator program for club and military stations was canceled after never being implemented. The action took place during the first meeting under new FCC Chairman Reed Hundt. *TNX San Gabriel Valley Radio Club's "The Loudspeaker," January 1994.*

Examiners Busted

The FCC has suspended the accreditation of several Southern California Volunteer Examiners following a three-month investigation. The Commission also invalidated the amateur licenses and license upgrades of 21 people. The testing sessions in question took place in the Los Angeles area in June and August of 1993. Both involved the ARRL and W5YI VECs.

Details are still sketchy as this goes to press, but there are indications the investigation could be turned over to the Department of Justice for further inquiry. Should the Justice Department seek prosecution on fraud charges, a lot of people could face heavy fines or jail time as a result.

FCC Personal Radio Branch Chief John B. Johnston W3BE commended both the ARRL and the W5YI group for their joint cooperation in uncovering the irregularities in the L.A. testing sessions. He also praised them for their quick action in suspending the Volunteer Examiners believed to be involved. *TNX Westlink Report, No. 664, December 31, 1993; ARRL; and Newsline.*

Cheap Chips

Less expensive integrated circuits are on the way because Sumitomo Chemical recently resumed production of epoxy resin. This special resin is necessary to produce memory chips. Experts believe this may lead to a quick end of the worldwide shortage of memory ICs.

Sumitomo Chemical has dominated worldwide production of epoxy resin. Production was interrupted last summer, however, by an explosion at the manufacturing plant. Another Japan-based chemical firm, Nippon Kayaku, says its new resin production facility will soon be constructed. It will produce resin for a 16-megabit DRAM chip. *TNX Westlink Report, No. 664, December 31, 1993.*

3-D Moving Forward

Following a series of meetings in both the United States and Germany, AMSAT's Phase 3-D Project Development Team has stepped up construction speed on amateur radio's newest satellite. Organizers say the project Is "on track" for the launch of Phase 3-D slated for 1996.

According to Engineering V.P. Dick Jansson WD4FAB, "Each country's team is performing their assigned tasks very well." Dr. Tom Clark W3IWI, AMSAT North America's President Emeritus, added that the team is " . . . really pulling together as an international group. Thanks to the work of our European, South African, and Japanese friends, it now looks like we will have some superb cameras, some really 'hot' receivers, and some very powerful transmitters on Phase 3-D." Clark is now a key member of the team's Global Positioning System experiment group. *TNX Keith Baker KB1SF.*

Getting Started With Satellite Imagery

Enjoy a bird's-eye view using your PC and VHF rig.

by Tom Glembocki KO4BD

Now that the amateur ranks are growing again with large numbers of no-code licensees in the VHF bands, it may be time to look at what else can be done with some of this VHF radio equipment coupled to a personal computer. With very little effort, a VHF receiver, 2 meter antenna and personal computer can be pulling in signals from the orbiting weather satellites and displaying these images on the screen. Receiving weather imagery from one of these satellites operating in the VHF frequencies is no harder than listening to the local repeater. Here's a guide to what it takes to get going in this captivating hobby.

The driving force in making the reception of imagery easier than ever is, of course, the march of technology. The National Oceanic and Atmospheric Administration, NOAA, recently celebrated the 30th anniversary of the first polar orbiting weather satellite, *TIROS-1*, launched April 1, 1960. Three years after that historic launch, on December 21, 1963, the launch of *TIROS VIII* made imagery collected by satellite directly available to hundreds of ground stations. Many of these early stations were amateur radio operators because they had the VHF radio equipment in the shack and the technical know-how to track and tune into the weather imagery, nicknamed "Direct Readout" by NOAA. In the 1970s, *73 Magazine* published the *Weather Satellite Handbook* by Ralph Taggart WB8DQT, a book which has become the bible for weather satellite do-it-yourselfers. The latest edition of this handbook, now published by the ARRL, was printed in 1990. Of course, advancing technology has already made some of the hardware projects in this edition out of date! (The book is still very useful and is a "must have" for the satellite information content.)

> ***"The driving force in making the reception of imagery easier than ever is, of course, the march of technology."***

The primary change that has taken place in the last few years is the influence of the personal computer. A good way to stay in touch with the technology changes for satellite imagery, besides reading *73 Magazine*, is to subscribe to the "labor of love" journal, *WeatherSat Ink*, 4821 Jessie Drive, Apex NC 27502; Fax: (919) 362-5822; published quarterly for $18 US, $23 foreign per year. Over the past 30 years radio amateurs have been building data demodulators for the satellite signals and have concentrated on converting old Western Union fax machines or slow-scan TV equipment for display devices. With the prevalence of personal computers equipped with displays capable of faithful rendering of imagery at affordable prices, radio amateurs no longer have to "roll their own" to display good imagery. Demodulator hardware has also become incredibly inexpensive. Many companies, some of them advertising in the pages of this magazine, now offer plug-in cards that do all the work. One of the cards, the WEFAX Explorer from Quorum Communications, Inc., even includes the radio on the computer card! This is an instant weather satellite ground station—just add an antenna.

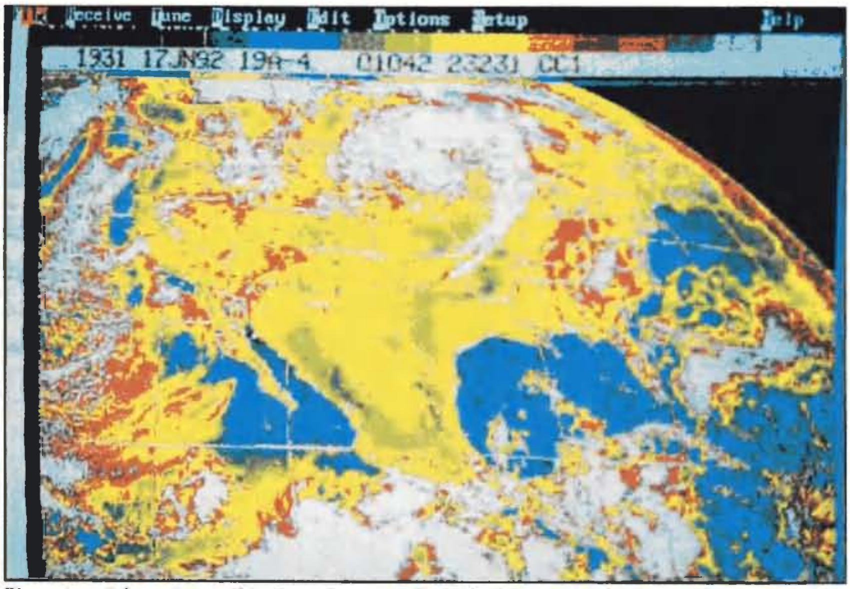


Photo A. A false color visible light picture of the United States received over shortwave radio. (Photo courtesy of Software Systems Consulting.)

What's Up There?

Every day, a half dozen satellites circling the earth continuously take pictures of the planet below in an orbit that completes every hundred minutes. The picture information scanned from the terrain below is broadcast a line at a time as the bird moves forward in orbit. This information can be received by any radio listening below as the signal passes over. No complex antenna tracking or tuning is required. The NOAA polar orbiters use a 5 watt transmitter broadcasting an FM signal on one of two frequencies, 137.5 MHz or 137.62 MHz, and are flying at an altitude of about 400 miles up. The signal is loud enough that I have been able to hear it on my

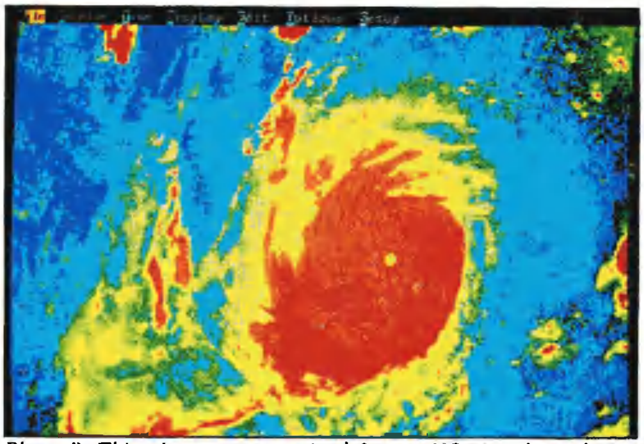


Photo B. This picture was received from a NOAA polar orbiting satellite on 137 MHz. It shows Hurricane Andrew as it approached landfall near Florida. (Photo courtesy of Software Systems Consulting.)

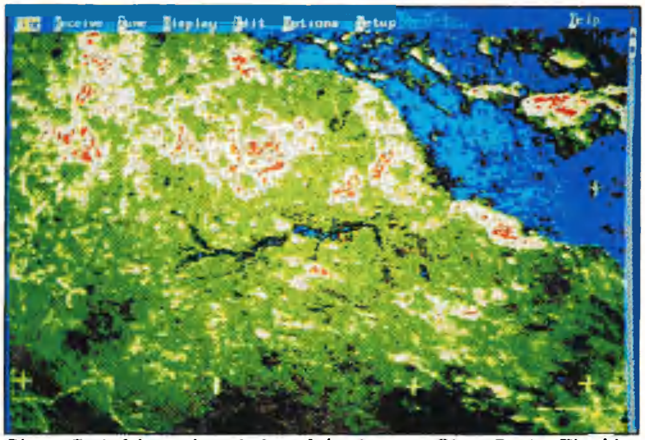


Photo C. A false color pictire of the Amazon River Basin. The blue Amazon River can be seen against the green background of the jungle. The white areas with red highlights indicate thunder cells that form over the Amazon Rain Forest daily, contributing to the lush growth there. (Photo courtesy of Software Systems Consulting.)

Bearcat 100XL hand-held scanner with a rubber duckie antenna. Of course, for best results a good omnidirectional VHF antenna is helpful. You don't need a special 137 MHz antenna—any 2 meter omnidirectional antenna will do because we are not interested in transmitting and thus are not too concerned with VSWR. A 2 meter beam will also do well, but because the beam is directional, you will have to constantly aim the antenna at the satellite as the satellite travels overhead.

The Russians also have a series of weather satellites in the same 137 MHz frequency band as NOAA and these are

"Knowing when to listen is the key to any capture of satellite imagery."

even easier to hear because they use a 7 watt VHF transmitter for their signal.

Knowing when to listen is the key to any capture of satellite imagery. In the old days before computers (1980s), to determine if a satellite was passing overhead I used to leave my Bearcat scanner running with the squelch on and the volume slightly turned up. When a satellite passed over, the radio would unsquelch and the loud 2400 Hz beeping of the passing satellite would ring throughout the house—usually just as the family was sitting down for dinner. Technology has fixed this problem—there are now over a dozen brands of tracking programs available that graphically display on the screen where all the weather satellites are located at any point in time and, more important, when the next one will be passing over your QTH. Some of these programs are available as shareware and others are programs for sale. I use InstaTrak sold by

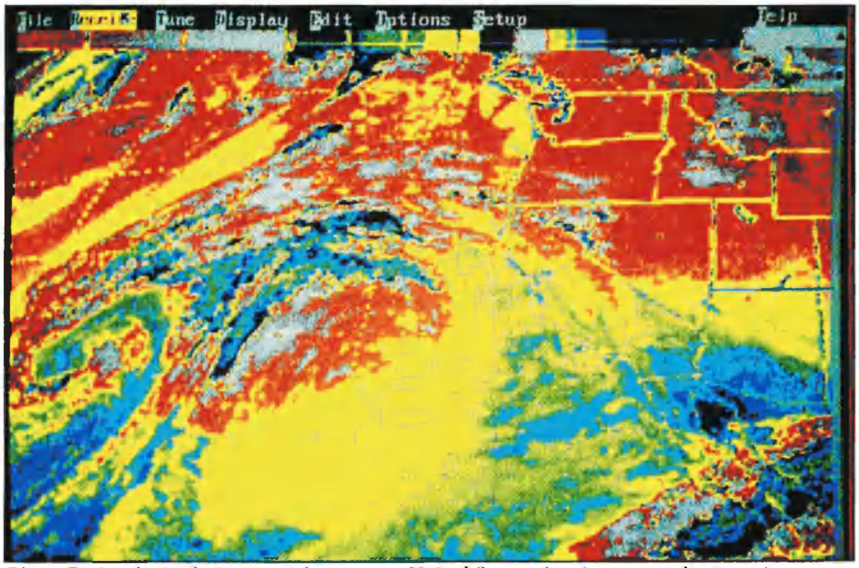


Photo D. A colorized picture of the western United States showing atmospheric moisture as a function of color. A legend is visible across the top of the display, but essentially the order of colors is: black, blue, green, yellow, red, and white. This order of colors shows progressively greater moisture content in the atmosphere. (Photo courtesy of Software Systems Consulting.)

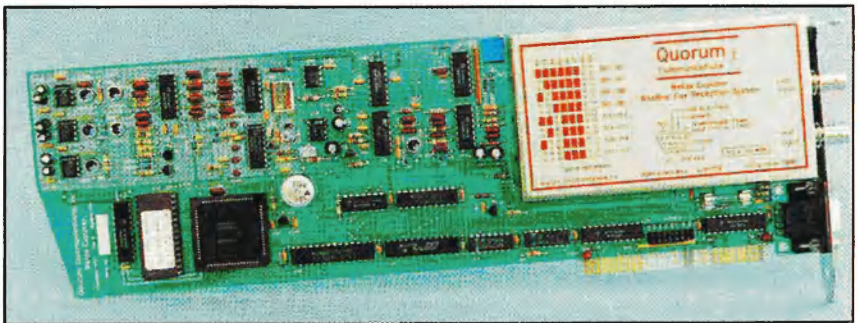


Photo E. One of many systems available for easy weather fax reception. (Photo courtesy of Quorum Communications, Inc.)

AMSAT for $80; however, as with any program, all the tracking programs achieve the same goal—satellite orbit prediction. The differences are in user interface, presentation of the data, and bells and whistles. One of the shareware programs, TRAKSAT, is available from the following BBSs: Celestial at (513) 427-

Photo F. Three-dimentional image of Hurricane Andrew taken from NOAA-11. (Photo courtesy of Quorum Communications, Inc.)

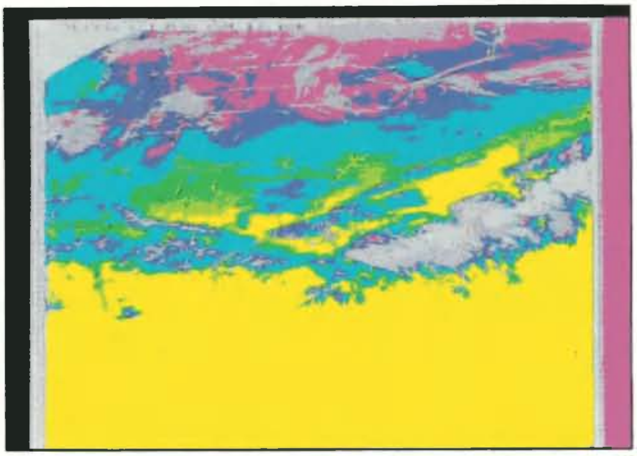


Photo G. A morning IR Meteosat shot taken when things were still cool. Note the false color from software. (Photo courtesy of Multi-FAX.)

0674, SatTrakers at (714) 590-4382 or Quorum Communications, Inc. at (214) 915-0346.

The following table lists the currently operating Russian and US weather satellites:

POLAR Orbiters

NOAA-9:	137.62 MHz
NOAA-10:	137.50 MHz
NOAA-11:	137.62 MHz
NOAA-12:	137.50 MHz
METEOR 2-20:	137.85 MHz
METEOR 3-3:	137.40 MHz
METEOR 3-4:	137.30 MHz

Once you know when to listen, wait for the familiar beeping sound to be faintly heard in the static as the satellite rises above the horizon. When the signal gets loud and strong enough to be noise-free, start up the image capture program and watch in awe. Line after line that the satellite passes over will appear on the computer screen. Each line represents a swath about 2,800 km wide from east to west. If it's winter, you may see snow on the ground in the imagery, or possibly ice flows in rivers and large bodies of water.

Summer reception will show the development of thunderstorms, or differences in vegetation cover and farm crop development. I usually sit in endless fascination at the pictures that appear before me on the computer screen.

VHF Radios for Weather Satellites

Many popular "police" scanner radios are available from Uniden Bearcat, Radio Shack and others. These cover the 136 to 137 MHz satellite band. If you use a scanner receiver, the regular communications IF bandwidth of the scanner is probably not optimum. The ideal IF bandwidth of your receiver needs to be about 42 kHz. A wide bandwidth will mean the signal will be weak and there may be too much background noise to see the picture. If the bandwidth is too narrow, the white areas of the picture may come out gray or noisy.

The March 1991 issue of *73 Magazine* has an article by John Hoots on page 12 with a description of modifications that can be made to some scanners to improve the IF bandwidth.

Another approach would be to use a high quality VHF/UHF receiver, such as the ICOM R7100 shown in the cover photo. This rig works well and will even correct for doppler shift as the satellite approaches and retreats.

Ready-made satellite receivers with the correct IF bandwidth are available from several sources. These sources are:

Vanguard Labs, 196-23 Jamaica, Hollis NY 11423; tel. (718) 468-2720.

Hamtronics, Inc., 65-D Moul Road, Hilton NY 14468-9535; tel. (716) 392-9430.

Quorum Communications, Inc., 8304 Esters Blvd., Suite 850, Irving TX 75063; tel. (214) 915-0256, fax (214) 915-0270.

Spectrum International, PO Box 1084, Concord MA 01742; tel. (508) 263-2145.

PC Satellite Image Capture Cards

The audio from the earphone jack of your scanner needs to go to a weather satellite facsimile card in your PC. The software that comes with the PC card does the rest. For best results you need a VGA or SuperVGA monitor on the PC. That's all there is to it!

Here are a few prices for various weather facsimile PC cards:

Vendor Addresses:

A & A Engineering
2521 W. LaPalma, Unit K
Anaheim CA 92801
Te. (714) 952-2114
Fax (714) 952-3280

MultiFAX
143 Roliin Irish Road
Milton VT 05468
Tel. (802) 293-7006
Fax (802) 893-6859

OFS WeatherFAX
6404 Lakerest Ct.
Raleigh NC 27612
Tel. (919) 847-4545

Quorum Communications, Inc.
8304 Esters Blvd., Suite 850
Irving TX 75063
Tel. (214) 915-0256
Fax (214) 915-0270

Satellite Data Systems
P.O. Box 219
Cleveland MN 56017
Tel. (507) 931-4849

SSC/Software Systems Consulting
150 Avenida Cabrillo, Suite C
San Clemente CA 92672
Tel. (714) 498-5784

Timestep (dist. by Spectrum International)
Spectrum International
P.O. Box 1084
Concord MA 01742
Tel. (508) 263-2145

Vanguard Electronics
196-23 Jamaica
Hollis NY 11423
Tel. (718) 468-2720

WeatherSat Ink
4821 Jessie Dr.
Apex NC 27502
Fax (919) 362-5822

•Multifax	$250
•OFS WeatherFAX	$445 assembled and tested: $395 kit form
•Timestep ProSat	$399
•Satellite Data Systems	$799
•Quorum Communications. Inc.	$695

Check the ads in *73 Magazine* or *WeatherSat Ink* for features and other available equipment. An example of a package deal is the one from Quorum Communications, Inc. For $495 they have a combination receiver and demodulator card that plugs into your PC. The addition of an omnidirectional VHF antenna is the only other piece of equipment you need (in addition to your computer).

Once you start pulling in satellite imagery on your computer screen you'll be hopelessly addicted. The imagery changes every day with the weather and seasons. You may find yourself looking forward to that next big snowstorm or hurricane so you can have a bird's-eye view from the comfort of your shack. As with all hobbies, once you get hooked you start looking for ways to do more and more.

Well, satellite imagery doesn't disappoint. After the initial thrill of pulling in images live from space wears off, a whole new world remains open for exploration. Temperature calibration of the infrared imagery from these birds allows you to measure water temperatures. Color enhancement of the temperature differences on the PC screen will reveal the Gulf Stream or Labradorian current or where the best fishing is. Several individuals have launched successful businesses marketing sea surface temperature maps to marinas and commercial fisherman. In the months ahead we hope to present many facets to this fascinating hobby. Stay tuned!

Using the World's Most Accurate Frequency Standard, Part 3

Building a good secondary frequency standard.

by Bob Roehrig K9EUI

A good frequency standard is an important piece of test equipment for any shack. With a little effort, you can build a unit that is 10 or 100 times more accurate than the oscillators found in most frequency counters.

Crystals are variable devices. They must be used with care to operate correctly. The main problem with an oscillator is drift, which is caused by many things:

1. Crystal aging
2. Temperature change
3. Varying drive levels
4. Oscillator component variations
5. Circuit loading changes
6. Power supply variation

All these variables must be kept to a minimum to end up with a stable oscillator. Most of these items have been discussed in detail in other articles and I recommend that you read as many as you can of the references at the end of this article. The frequency standard described here has been designed to keep these variations to a minimum.

There are two ways to mimimize the temperature drift problem. You can use a circuit with temperature compensating components that have the opposite temperature coefficient of the crystal (a TXCO); or you can use a standard circuit and just keep the crystal and the oscillator at a constant temperature, which is far easier. Just holding a crystal at a constant temperature is not quite good enough either. The temperature must be set at the upper turning point to be the most stable.

As a crystal is heated up above room temperature, its frequency decreases. The rate it decreases depends on how the crystal was cut. As the temperature increases the frequency eventually stops decreasing, then begins to go up. This leveling out area is called the *turning point* and this is where the crystal should be operated.

"Crystals always age, meaning that the frequency will naturally change with use even though everything else remains constant."

Crystals always age, meaning that the frequency will naturally change with use even though everything else remains constant. Aging is said to decrease logarithmically with time and will eventually drop off to a low rate of a few parts per million per year or less. Aging can be kept to a minimum by using the lowest crystal drive current possible. The most efficient way to control drive is with an AGC circuit. That way the circuit gain is initially high to start oscillation, but then is reduced to a level just high enough to maintain oscillation.

The Oscillator Circuit

If you read the references listed below you will find out that there are dozens of oscillator circuits, all claiming to have some advantage over another. The oscillator I chose is similar to the Goral circuit, which is a variation of the Colpitts circuit. The Goral circuit adds a follower (Q2) which provides power gain. This permits using much larger values for the capacitors, C1 and C2, which reduces drift caused by minor variations in these component values with temperature change. It also reduces any capacitance effect caused by the oscillator device, (Q1) itself.

The main difference between my oscillator and the Goral circuit is the use of amplified AGC to control the drive level, rather than the simple scheme used in the original Goral circuit. The negative AGC voltage (typically -2 volts) is applied to the gate of

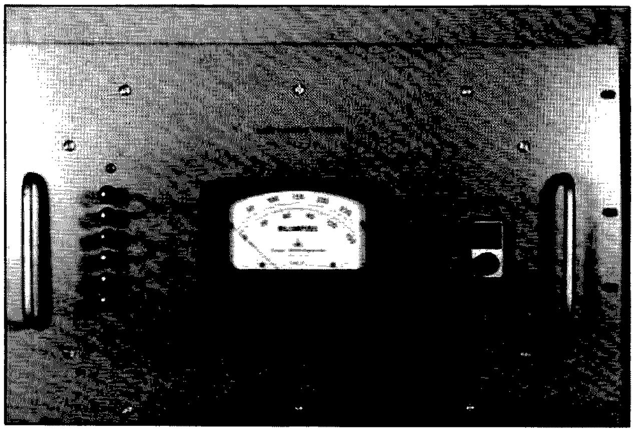


Photo A. A view of the frequency standard front panel.

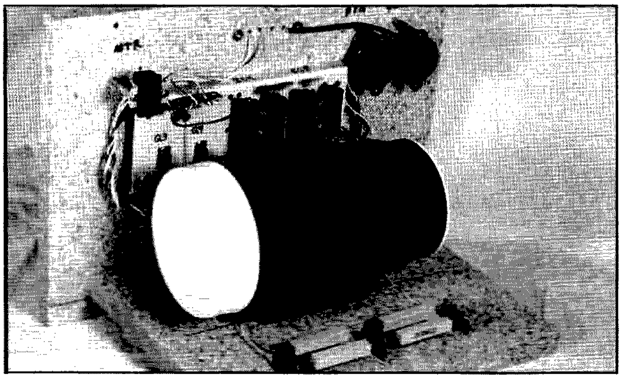


Photo B. A view from the rear showing the shelf and thermos bottle. Note the power transistors, voltage regulators, and outer oven heater resistors.

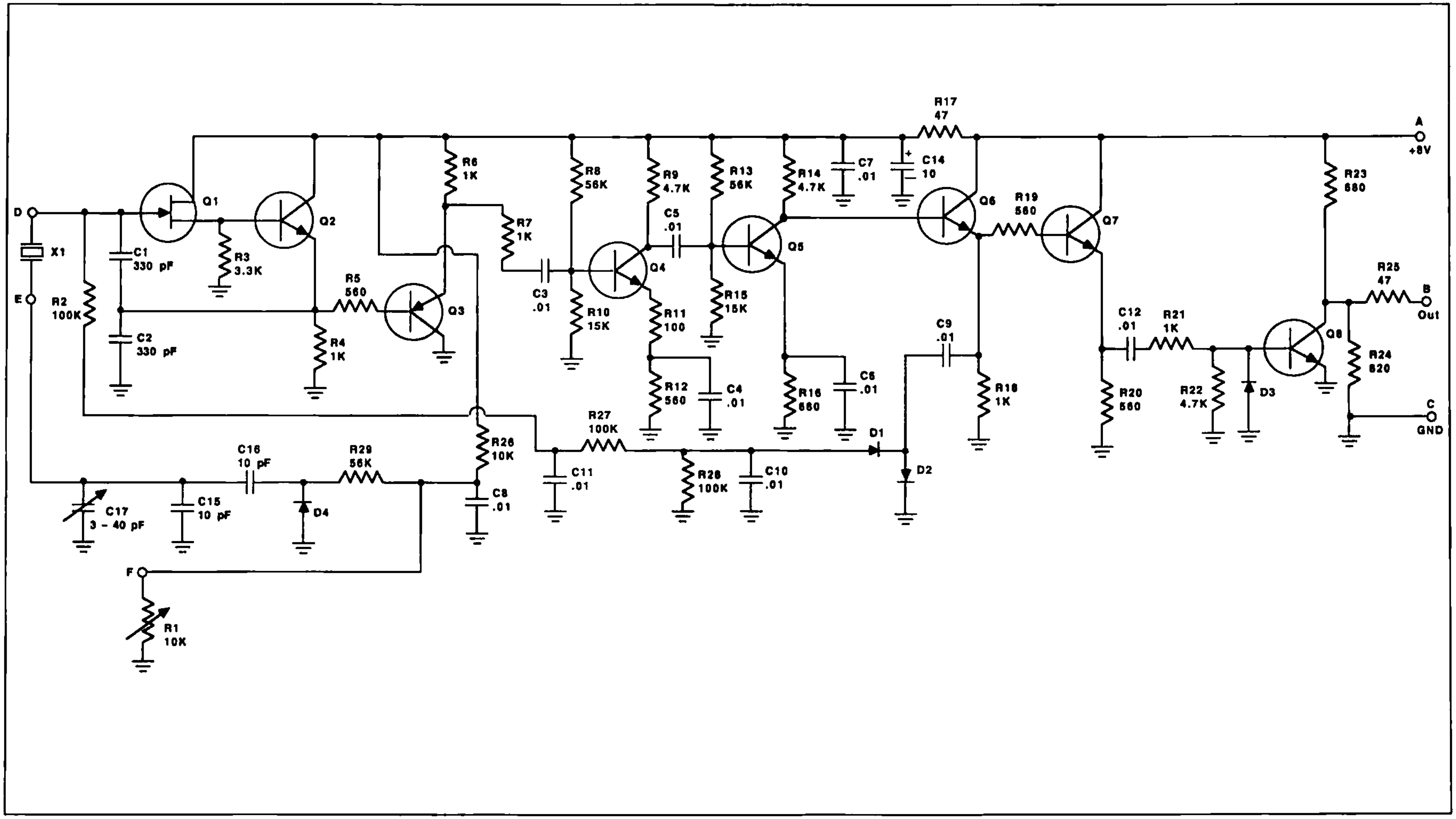


Figure 1. 1 MHz crystal oscillator.

Parts List, Figure 1

All resistors 1/4 watt.

Desig.	Value/Type	Digi-Key Part No.
C1,2	330 pF	DK P4806
C3-13	0.01 μF	DK P4513
C14	10 μF	DK P807
C15,16	10 pF	DK P4837
C17	3-40 pF Trim.	DK SG3008
D4	1N4001	
D1-3	1N914	
Q1	MPF102	
Q2,5-8	2N2222	
Q3	MPS2907 or 2N3906	
R1	10k 10-turn pot	DK 73JA103-ND
Dial for R1		DK 316-11CS-ND
R2,27,28	100k	
R3	3.3k	
R4,6,7,18,21	1k	
R5,12,19,20	560 ohms	
R8,13,29	56k	
R9,14,22	4.7k	
R10,15	15k	
R11	100 ohms	
R16,23	680 ohms	
R17,25	47 ohms	
R24	820 ohms	
R26	10k	
X1	1 MHz crystal from Jan Crystals. Specify HC6-U holder, 32 pF parallel load capacitance, 0.001% 55 degrees C operating temperature.	
X1 Socket	Jan Crystals type CE-1.	

Q1. With this circuit, crystal drive is reduced to less than 10 microwatts (less than 1/100 of what it would be without AGC).

Q3 is an additional follower to isolate the following stages from the oscillator itself. Because of AGC action, the DC level on the emitter of Q2 operates near ground, so Q3 must be a PNP device to provide proper DC operation.

Q4 and Q5 are high-gain amplifiers and follower Q6 provides a low source impedance for the AGC detector circuit, D1 and D2. Q7 and Q8 provide a TTL-compatible output signal. The output is a nearly symmetrical 5 volt square wave.

D4 and C16 perform as a variable capacitance diode to allow electrical fine-tuning of the oscillator frequency. The control voltage is provided by the divider consisting of R26 and R1. R1 is a 10-turn precision pot with a counter dial, mounted on the front panel of the unit. Increasing the resistance of R1 increases the frequency. Although the adjustment is somewhat nonlinear, the tuning rate is roughly one part in 10^6 per turn.

The Ovens

To be effective, the crystal and oscillator must be kept at a constant temperature, as said before. This means they must not be affected by changes in the surrounding environment. While testing my original oven unit, which housed everything in a minibox, I noticed that even a few degrees change in room temperature affected frequency. I finally decided that the best and most easily available housing for this unit would be a thermos bottle. The model I chose is the one-pint Food Jar model 7221. The top cup is not used.

The oscillator circuit is housed inside the thermos bottle and the oven heater consists of four 10 ohm 10 watt resistors (Figure 2, R26-29). Temperature control is provided by a thermistor (Figure 2, RT1) which is connected to the bridge circuit of Figure 2.

Even with the use of the thermos bottle housing and the proportional control scheme, outside temperature changes can still affect the inner temperature. This is solved by a second outer oven which is also proportionally controlled. The housing for the entire unit consists of a 3/4"-thick particle board box attached to the back of a 12"-high relay rack panel. The box dimensions are: 14" wide by 10" high by 10" deep. The inner surface of the front panel is lined with styrofoam insulation. The thermos bottle is fastened by its handle to a shelf which fastens to the rear panel.

"To be effective, the crystal and oscillator must be kept at a constant temperature."

Some of the oven control components (Q3, Q4, IC4, IC5, and associated components) are mounted on a 3" by 7" metal plate that is fastened to the rear panel. Resistors R30-33 mount on terminal strips on the shelf in front of the thermos bottle. (See photos.) Front panel connections to the frequency control pot and the meter selector switch are made through an 8-pin Cinch-Jones connector. A connector assembly is also used on the cabling from the thermos bottle so it can be easily disconnected and removed. Power and the 1 MHz output are connected to a barrier strip on the rear panel. If you use an external meter rather than an internal one as I did, you will need a larger barrier strip than one with only four screws.

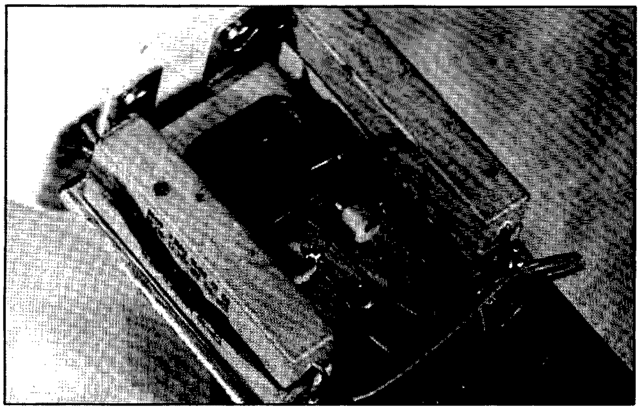


Photo C. Detail of the inner oven heater assembly. Note the heater resistors, crystal, and thermistor The assembly is mounted to the top of the thermos bottle and to the end of the oscillator board prototype.

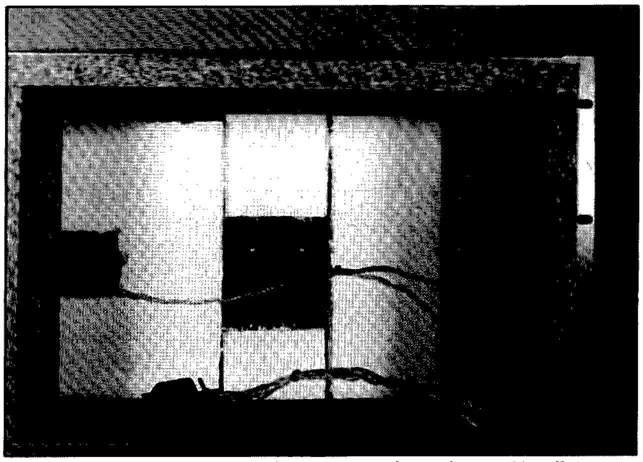


Photo D. Looking inside the box. (Photos by WB9DOF.)

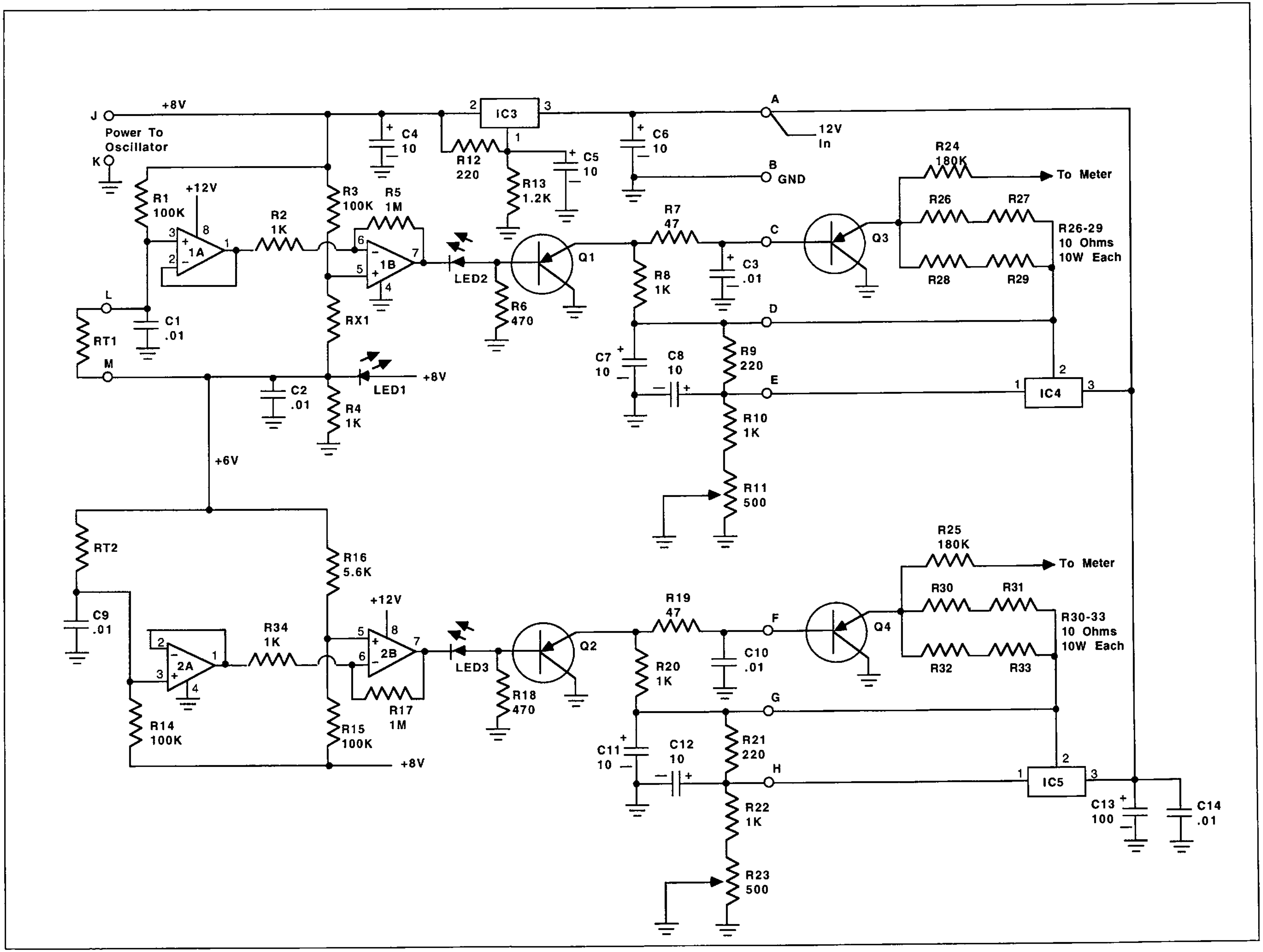


Figure 2. Oven control.

Parts List, Figure 2

All resistors 1/4 watt unless otherwise specified.

Desig.	Value/Type	Digi-Key/Radio Shack No.
C1,2,3,9,10,14	0.01 uF	DK P4513
C4-8,11,12	10 uF	DK P807
C13	100 uF	DK P833
Q1,2	MPS2907 or 2N3906	
Q3,4	MJEF34	RS 276-2027
IC1,2	LM 1458	RS 276-038
IC3-5	LM 317-T	RS 276-1778
LED1	2 volt panel LED	RS 276-018
LED2,3	2 volt LED	RS 276-046
RT1,2	Thermistor	RS 271-110
R1,3,14,15	100k	
R2,4,8,10,20,22,34	1k	
R5,17	1 meg	
R6,18	470 ohms	
R7,19	47 ohms	
R9,12,21	220 ohms	
R11,23	500 ohm pot	DK 36C52
R13	1.2k	
R16	5.6k	
R24,25	180k	
R26-33	10 ohm 10 watt	DK 10W-10 or RS 271-132
Heat sink for IC3		RS 276-1363
IC socket for IC1,2		RS 276-1995

Q3 and Q4 can be directly mounted to the aluminum panel in back since the collectors are at ground, but IC4 and IC5 must be insulated from the panel. I chose to mount them on individual heat sinks which are insulated from the panel with plastic hardware.

The thermos bottle is prepared by screwing in the stopper fairly tightly. The bottom of the unit will be the side of the bottle with the handle. This will be screwed to the bottom of the shelf. Mark the top edge of the stopper with a marking pen, then remove it.

The inner heater and crystal assembly is constructed on a 2"-square piece of aluminum. This is mounted on the blank end of the oscillator board with three small screws and nuts. The crystal socket mounts near the center of the aluminum with a small "L" bracket so the crystal is centered on the aluminum. On the end of the bracket, drill the board and the aluminum plate to mount two small L brackets which will mount the board assembly to the back of the bottle stopper. Using epoxy cement, glue two of the 10 ohm resistors along the outer edge of the aluminum plate. Then glue the other two resistors on top of these. Apply 8 to 9 volts DC to the oscillator circuit to make sure it and the crystal are operational. Then glue the thermistor (RT1) to the top surface of the crystal. Use sheet metal screws to mount the oscillator board L brackets to the bottle stopper. Make sure you position the board so it will fit into the bottle and be sure the top side of the board is towards the top mark you made on the stopper.

Tests and Setup

All connections should be made except to the oven resistors and R1. Connect a pair of wires to R1 using the two terminals that increase in resistance as the pot is turned clockwise. This way the resistance of R1 can be read directly from the counter dial.

Temporarily connect the pot to the control board in place of RX1. Ground the frequency control lead of the oscillator circuit (Figure 1, point F). With the oscillator out of the bottle, apply power to the unit. Connect a frequency counter to the oscillator output. This counter should be warmed up for at least 30 minutes in a stable temperature environment and its time base should be as close as possible to its correct frequency. Set the counter for a gate time of 10 seconds so you can read to the nearest 1/10 Hz.

Adjust C17 on the oscillator board for a frequency of 1,000,020 Hz. Turn off the power and install the oscillator inside the thermos bottle. Connect the inner oven leads to Q3 and IC4. Connect a DC voltmeter to the output of IC4. Turn on the power and adjust R11 for 9.5 volts. Connect the voltmeter to the emitter of Q3 to monitor the oven voltage.

The following procedure will determine the crystal turning point temperature and may take several hours. Set R1 to 2k and wait until the voltage across the oven stabilizes. Then note the frequency. Decrease the pot resistance in 100 ohm steps, waiting for temperature stabilization each time, and note the frequency. Repeat this procedure until at some point the frequency will begin to increase rather than decrease. Reset the pot to the resistance where you obtained the lowest frequency. You have now found the turning point. Do not be surprised if you must have the oven temperature as high as 80 degrees C. Even though you specify a 55-degree crystal temperature, the actual turning point may be much higher than this.

The frequency should read between 999.992 and 999.998 kHz. If it does, you are OK. If not, note the exact frequency and turn off power. Remove the oscillator from the bottle and let it stabilize to room temperature. Then reapply power and adjust C17 to increase or decrease the frequency by the amount it was off from 999.995 kHz.

Disconnect the pot from the oven control board and install a fixed resistor (or resistors) of the same value as the pot for RX1. Now connect the pot as R1 to the oscillator board. With the inner oven at normal temperature, you should now be able to adjust R1 for exactly 1 MHz.

Connect the outer oven resistors to Q4 and IC5. Connect the voltmeter to the output of IC5 and adjust R23 for 9.5 volts. RT2 and R16 will set the outer oven temperature to between 40 and 45 degrees C.

The thermistors and the temperature set resistors (RX1 and R16) are connected to a bridge circuit which is powered by the 6 and 8 volt supplies. This low voltage across the bridge prevents the current from heating the thermistors by the bridge source. The DC output from the bridge is amplified by 1,000. When the oven is cold, The amplifier outputs are near ground. Because of this and the 2 volt drop across LED2 and 3, driver transistors Q1 and 2 are turned on, which turns on Q3 and 4. When the temperature set point is reached the amplifier output swings positive, which forward biases the LED and turns off the oven control transistors. At normal operating temperature, the inner oven voltage will run around 4 volts and will vary slightly as slight corrections are made.

"Even with the use of the thermos bottle housing and the proportional control scheme, outside temperature changes can still affect the inner temperature."

The entire unit should be continuously powered from a 12 volt battery which is kept charged with a trickle charger to maintain battery voltage. In the event of a power failure, the battery will keep the unit operational down to the point where the battery reaches 11 volts.

R24 and 25 are used to monitor the oven voltages with a 50 microamp meter. This can be the same meter that is used for the WWVB receiver and the digital comparator units.

The output of the oscillator is connected to the 1 MHz input of the comparator and R1 is used to adjust the frequency for minimum phase shift compared to the WWVB signal. The oscillator output can also drive other devices up to the point where it is

loaded down too much. If necessary, you can buffer the output by using a CMOS hex inverter or buffer to obtain six independent outputs.

With a stable operating environment for the crystal oscillator, an accuracy of one part in 10^9 or better can be obtained.

References:

1. "High Stability Crystal Oscillator," *Ham Radio*, October 1974, page 36.
2. "An Experimental Frequency Standard Using ICs," *QST*, September 1974, page 14.
3. "Quartz Crystal Resonators," *Ham Radio*, February 1986, page 85.
4. "Quartz Crystals—Gems for Frequency Control," *Ham Radio*, February 1979, page 37.
5. "Survey of Crystal Oscillators," *Ham Radio*, March 1976, page 10.

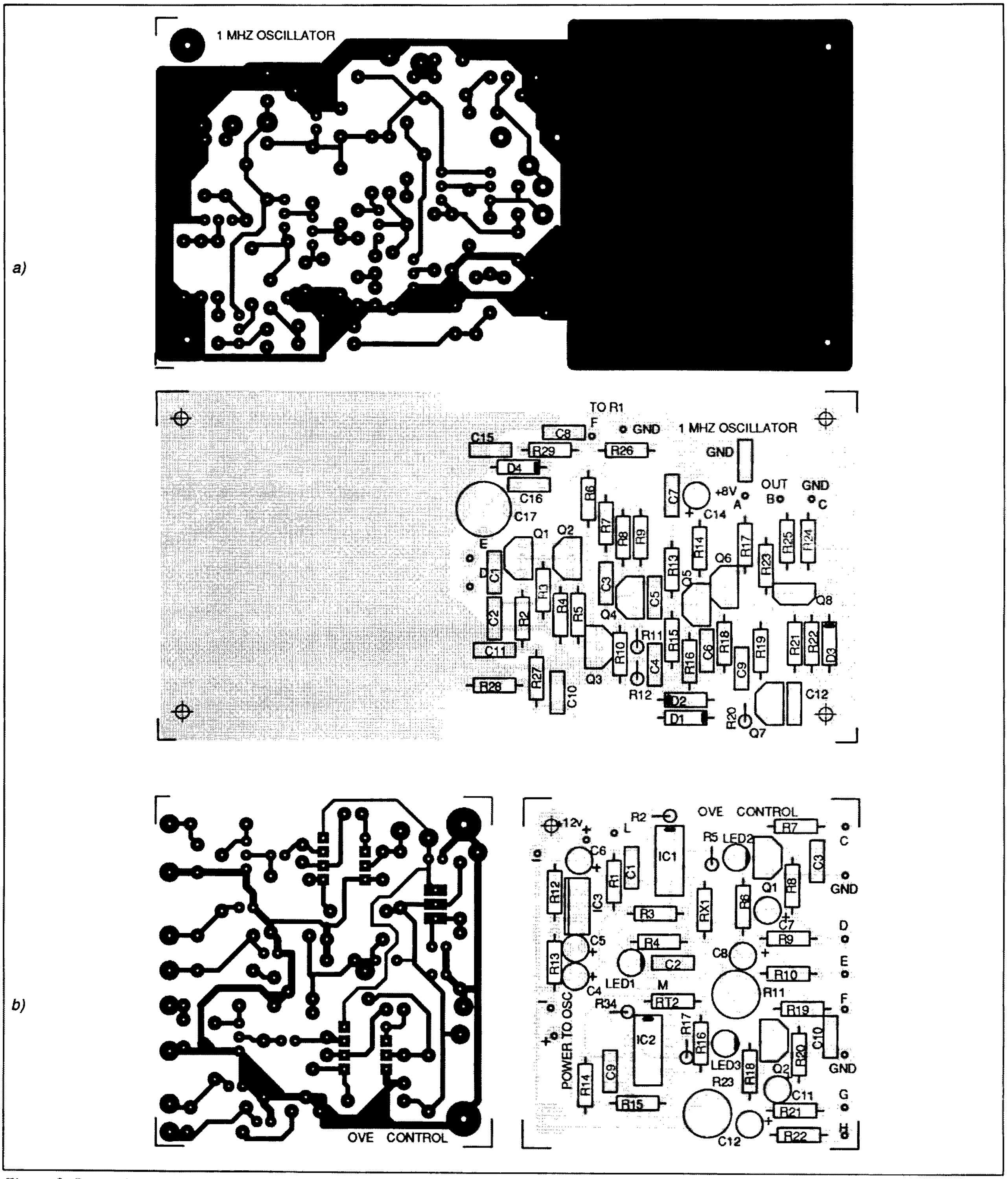


Figure 3. Parts placement and PC board pattern: a) 1 MHz oscillator; b) oven control. The set of both drilled and etched PC boards is available for $8 plus $1.50 S & H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

Number 6 on your Feedback card

The TW-1 Cheap Digital Front Panel

Easy thumbwheel tuning for the Techno-Whizzy 1.

by John Welch N9JZW

Way back in the December 1992 issue we built a Direct Digital Synthesis (DDS) HF CW Transmitter called the Techno-Whizzy 1. It was quite a nifty gizmo, but it had a few limitations. One of the most annoying was that the frequencies were hardwired in, using diodes for 11 "channels" with one "channel" being set, in binary, via dip switches. This limited you to only 12 different frequencies, with no easy way to go "up 10" if "your" frequency was in use.

Using diodes, however, did have one big advantage—it was cheap. Doing a real front panel with keypad input, LCD display, tuning knob, memories and so forth is a moderately expensive proposition. It will give you the most features, but it will cost about $150.

While Victor Morin VE1ABC was solving this shortcoming one way (see his article, "Computer Control for your Direct Digital Synthesis VFO," *73 Amateur Radio Today*, February 1994), I was working at another solution.

What I wanted was something small, simple and portable. It should add little to the power consumption, but give me the freedom to change to whatever frequency I wanted without needing to carry a whole PC along.

Mix three parts frustration with one part inspiration and you get the TW-1 Cheap Digital Front Panel. It doesn't have all the bells and whistles that a real radio would have, but then again it doesn't cost an arm and a leg either. It's simple to build, uses parts that are readily available on the surplus market (cheap), and requires no adjustments. Just plug it in and it works!

The TW-1 Cheap Digital Front Panel uses thumbwheel switches as the display and input device. Using the most common scheme for a look-up table would not have worked well, due to the number of output bits (23) and the large number of address lines (26). This would have required several megabytes of EPROMS and a board about a foot square. Not good enough!

A massive brain-hiccup got me thinking—I could make it run to 21.50 MHz in 10 kHz steps using three 27C256s, since that was only 14 bits of address and 23 bits of data out. I could go from 0 to 9990 Hz in 10 Hz steps using 12 address bits, which meant another two 27C256s. By adding the outputs, I would get the correct frequency input to the TW-1 for a fraction of the cost! And so it was done.

How It Works

By now, the power supply section should be pretty familiar stuff: +12 comes in J1, through diode D1 (to prevent damage in case you plug the unit in backwards), past an anti-ripple cap (C1), through the three-terminal 5 volt regulator U1 and past another anti-noise anti-ripple filter cap (C2). Diode D2 is there as a safety feature—if you're driving an inductive load this prevents the power-off spike from blowing up the voltage regulator.

The frequency is selected on the thumbwheel switches, SW-1 through SW-7. SW-1 through SW-4 (a block marked U13 on the schematic) control the high-position EPROMS and SW-5 through SW-7 (U14) control the low-position EPROMS. This allows setting the frequency in 10 Hz steps from 0 to 21.5 MHz (the upper limit on the TW-1 VFO board).

The thumbwheel switches are connected to the address lines of the EPROMS, at the junction of the pull-up resistors and the EPROMs. On the EPROMS, the address lines are pulled to +5 volts by resistors (RP1 and RP2). The thumbwheel switches pull some of these lines to ground, based on the switch settings.

The EPROMS form a look-up table: the output of the EPROMS are the binary settings to the TW-1 VFO board needed to make it run on the frequency you've selected at the switches. There are five EPROMS, with each PROM giving a portion of the 23 data bits needed.

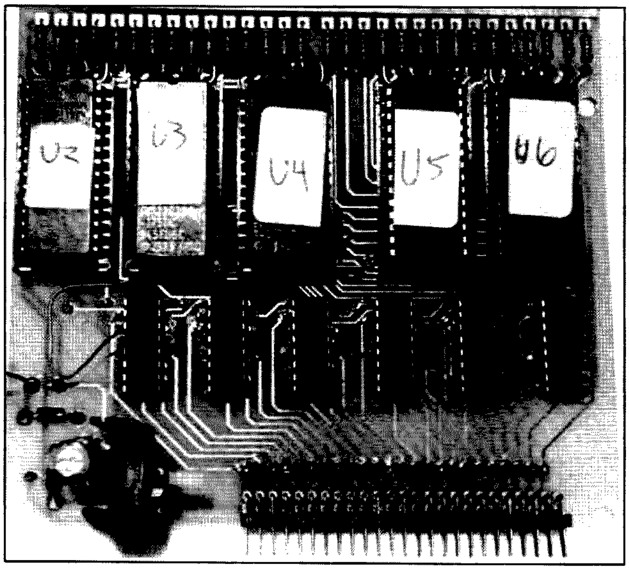


Photo A. The completed board.

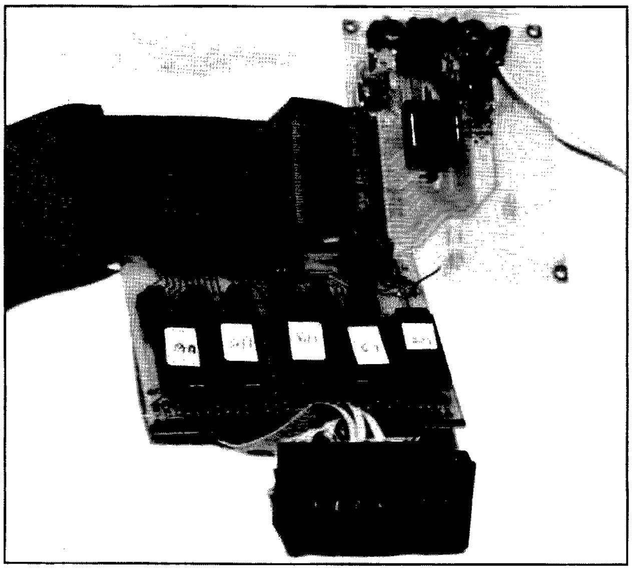


Photo B. The new board connected to the TW-1 DDS board.

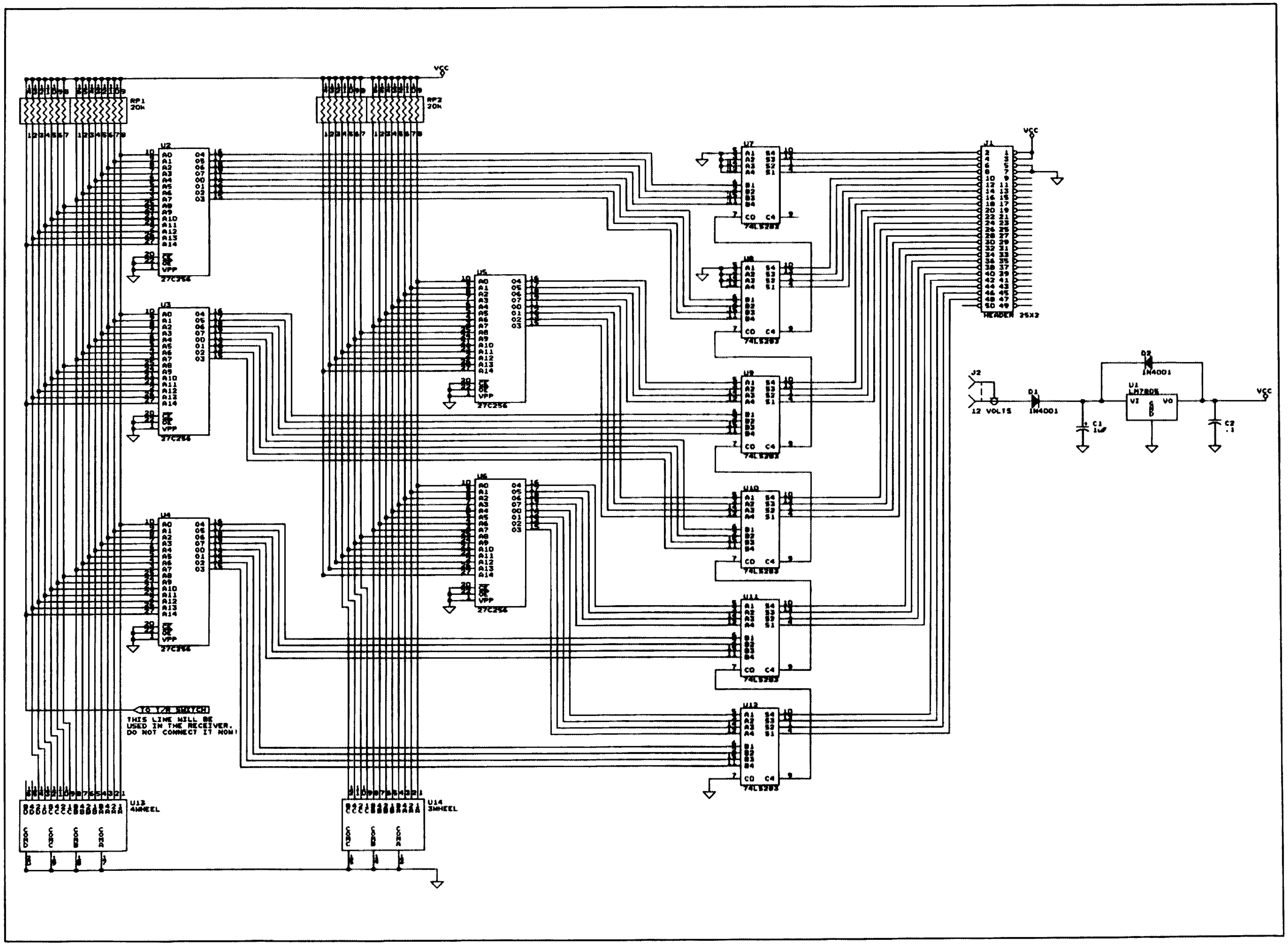


Figure 1. Schematic diagram for the Thumbwheel Switch for TW-1.

There are two banks of EPROMS, one for the MHz and high kHz digits (U2-U4) and one for the low kHz through 10 Hz (U5 and U6). The output of each bank is added together by U7 through U12, six 4-bit adders with carry. The resulting 23-bit value gets connected to the input of the Q2220 DDS chip via the 50-pin header (J1) and ribbon cable.

The whole frequency selection stage is static (that means it uses no clock signals, it's just DC voltages). Changing frequency is as easy as flipping the switch. There is some propagation delay through the Q2220 chip, but it takes so little time (110 nanoseconds) that it's effectively instantaneous. There's little or no drift using the Epson oscillator, so you'll be right on frequency from the moment you turn the TW-1 on.

The Program

For those of you with an EPROM burner and Borland C 2.0 or later, I've included the source code for the program to build the EPROM tables. For those without these, I've also included the 5 EPROM files, U2 through U6. These are available on the *73 Magazine* BBS at (603) 924-9343, 300 through 2400 baud, 8 bits, no parity. There is a source for kits for this project at the end of the article. And that leads us to . . .

How to Build It

I would *strongly* suggest buying the circuit board for this, unless you can make your own plated-through holes. There are quite a few connections from the top to the bottom (called "vias"). Also, there are traces that connect under the adder chips. These make life very difficult if the connections are not plated through. You *can* do it (I did. Once. Never again!) but doing so takes a *lot* of patience and time for debugging. Be forewarned!

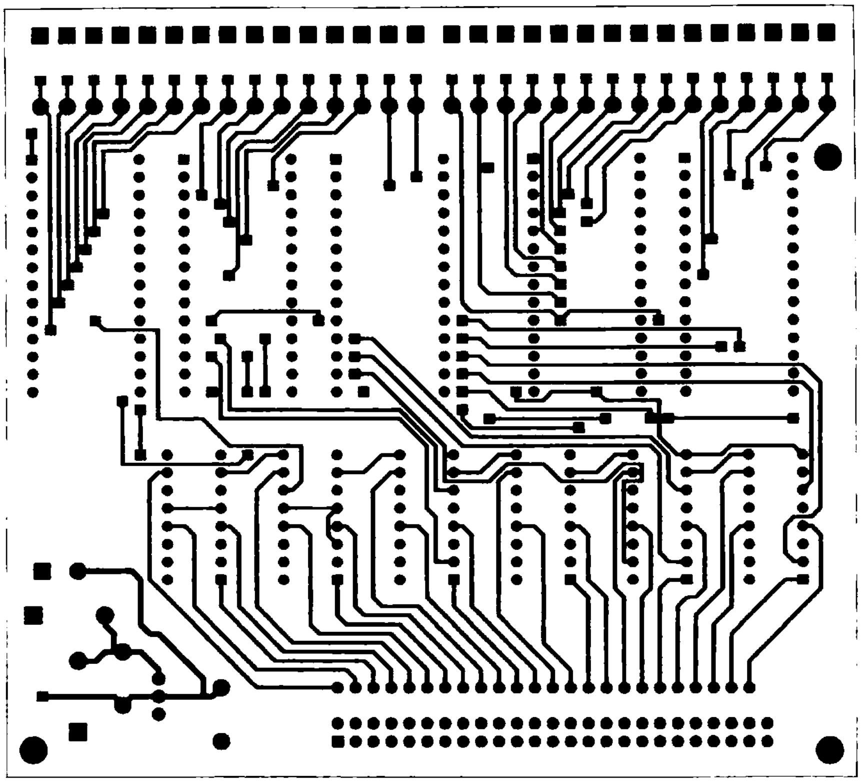
Build the power supply first. Install U1, the 5 volt regulator. Make sure it matches the outline on the silk-screen. Also, U1 will get hot so put a TO220-type heat sink on it.

Install the two protection diodes, D1 and D2, making sure the banded end points the same way as the silk-screen. Install the filter caps, C1 and C2, next. Finally, install the wires that will lead to your 12 volt supply at J2.

Temporarily solder a 10k resistor in parallel with C2 (from +5 to ground) and apply power. Across the resistor you should read 5 volts DC (plus or minus about 0.2 volts is fine). If you get nothing (0 volts), check D1 for correct polarity. The cathode (banded end) goes towards the voltage regulator. If you get 12 volts, check D2 for correct positioning. If that's correct, you may have a bad regulator (or it may be installed backwards). Correct any problems here before continuing.

Remove that 10k resistor and proceed by soldering in the 50-pin cable connector J1. Solder in the adder chips, U7 through U12. Either 27HC283 or 27LS283 chips will work, but the HC parts consume slightly less power.

Attach the ground jumpers, following the


a)

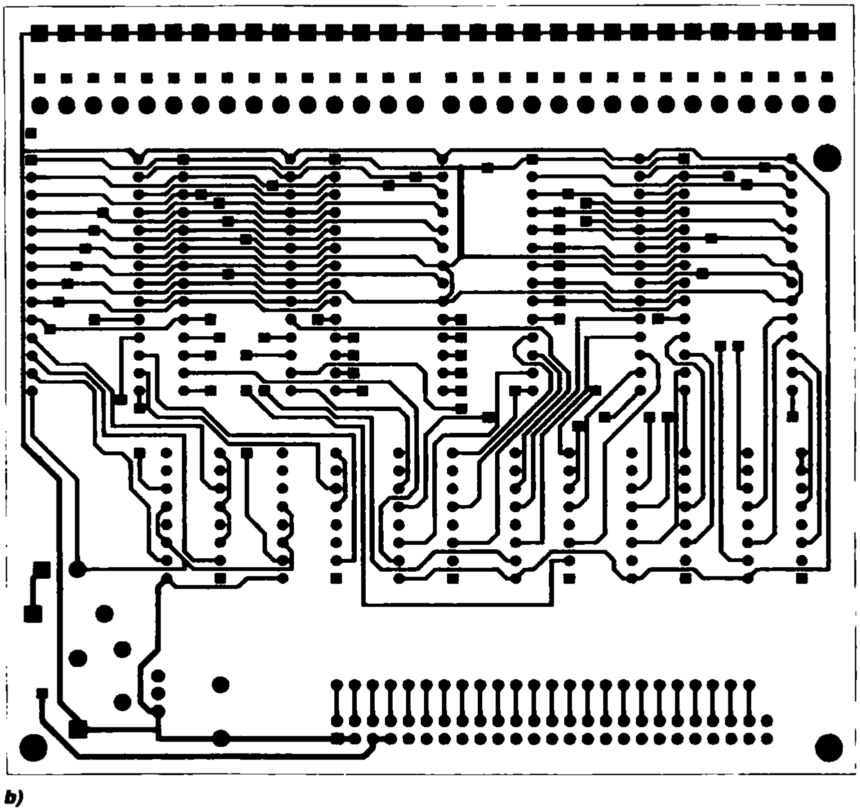
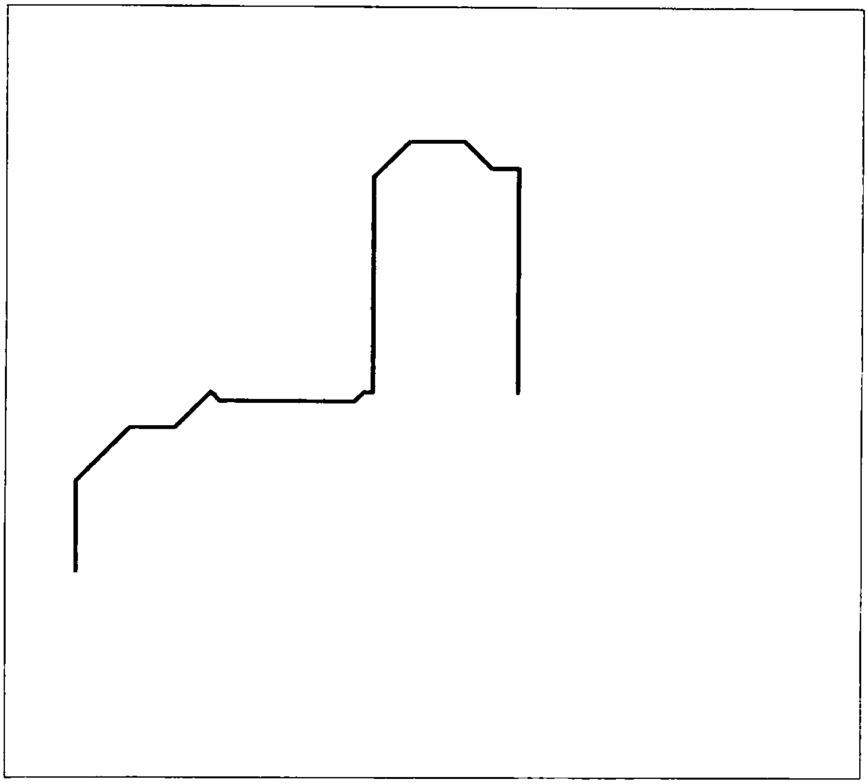
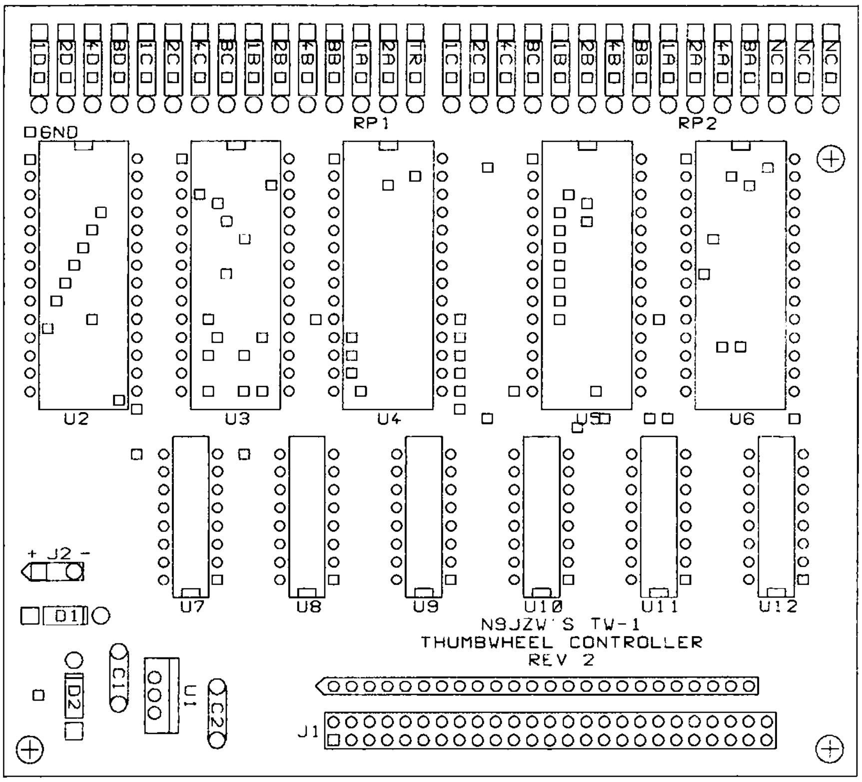

b)

Figure 2. PCB artwork; a) Top; b) Bottom as seen from top;



c)



d)

c) Jumpers; d) Silk-screen parts placement overlay.

lines on the silk-screen. These jumpers bring ground to some isolated bits of the circuit.

Take two pieces of ribbon cable, each 15 wires wide and about 8-10 inches long. Peel all the wires apart for about two inches on each end. Strip and tin both ends.

Solder one end of the cable to the pads under the pull-up resistors (RP1 and RP2). Then, solder the resistors RP1 and RP2 (each set consists of 15 10k to 20k ohm 1/8 watt resistors) in over the top of the wires.

Next, solder-in the EPROMs (U2-U6) (it would be a good idea to use sockets for the PROMs, as I will probably be changing the code in them when I get the receiver done). Note that the EPROMs "point" the opposite direction as the adders! This is correct.

Now comes the fun part—hooking up the thumbwheel switches to the ribbon cables. Start out by looking at the back of your thumbwheels. There should be five pins (or traces or places to solder wires on) labeled 1, 2, 4, 8 and Common (sometimes just C). Those are the connections we'll be using. On the switches in the kit there is another unused pin: /C, or NOT COMMON.

If your switches are labeled 1 through 10 plus Common, you have the wrong type of switches. Some surplus houses have these very cheap because few people want them. They will not work with this board, and cannot be modified to work with it. The correct type of switch is a BCD TRUE OUTPUT switch.

Tracing back from the board, find the four wires labeled 1D through 8D. Solder wire 1D to connection 1 on the tens digit (that's the right-most digit you have). Solder wire 2D to connection 2, 4D to connection 4, and 8D to connection 8.

Repeat the procedure for wires 1B through 8B on the hundreds digit, and wires 1A through 8A for the thousands digit. Move over to the other cable and do the same with "D" connecting to the ten-thousands digit, "C" to the hundred-thousands digit, "B" to the one megahertz digit, and "A" to the 10 megahertz digit.

Note that wire set A only has two wires, 1A and 2A. Leave the other two wires unconnected for now (we'll use these in the receiver project).

Tie all the COMMON connections on the switches together and run a wire from there to the ground on the board. There is a pad just between U2 and the resistors for this.

Set all the switches to 0 and apply power to the board. First, check the power and ground pins on J2 for +5 and 0 volts. Then go across the data pins. All of these should read less than 0.2 volts.

If one doesn't, trace it back through the adder to the EPROM. Is the adder getting a 5 volt input where it shouldn't be? If not, either the adder is defective, there's a short in some trace, or the adder may not be getting power and ground.

If the EPROM is putting out a 5 volt signal, check the pull-up resistors. At the junction of the resistors and the ribbon cables, all should read 5 volts. If any do not, you may

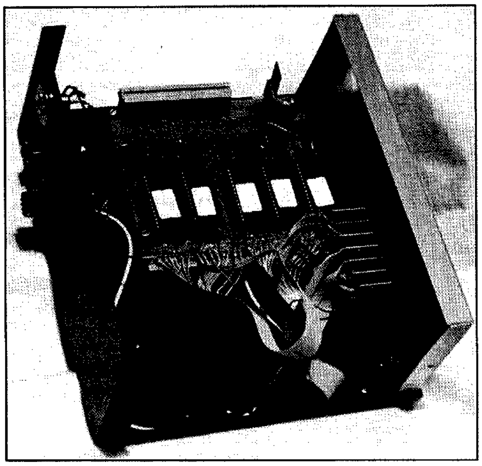


Photo C. The new TW-1 in a nice enclosure.

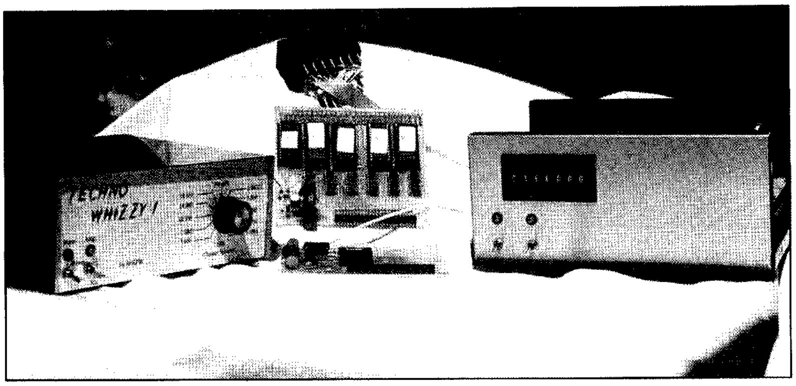


Photo D. The TW-1 DDS board surrounded by the new TW-1 and the original TW-1.

have mis-wired the switch or you may possibly have a short on the circuit board.

Now, set the switches to 1431300, and check the voltages again. You should have (from left to right on J2) 1000010100111101101110100, where 1 indicates 5 volts and 0 indicates 0 volts. If not, trace the signal back as above.

If you've gotten this far, the board seems to be functional. We can give it the final test now. Remove power and attach it to the TW-1 DDS board by plugging the 50-pin cable to the 50-pin connectors on each board. Note: You shouldn't have the diode board hooked up at the same time.

Hook the thumbwheel board back up to 12 volts and hook a frequency counter to the output of the DDS board. As you change the switches, the DDS output should also change to your new setting. If it doesn't change to the frequency you've got set, check the wiring on the switches (Did you hook a 4 up to a 1 by accident, like I did?).

When it does track correctly, you're all done with the electronics. Take some time to glop a little RTV or silicon bathtub caulk over the resistors and ribbon cable connections. This helps keep those connections from breaking while you install it.

Put it back in your TW1 case, attach the amplifier and start calling CQ. You've got a stable digital wideband VFO, and you're on your way to having a complete, state-of-the-art DDS transceiver.

About the TW-1

The TW-1 is a modular Direct Digitally Synthesized radio. So far, the rig consists of the DDS VFO board that will cover from 3.2 Hz to 21.5 MHz in 3.2 Hz steps, the Class A amplifier board (with additional optional filtering), and three different frequency selection boards, the Thumbwheel Switch board described above, a computer-controlled parallel interface and a cheap, less functional diode matrix board. Feel free to design your own board for it (I'm still looking for a good receiver and a better amplifier . . . hint . . . hint . . .).

Kits for these boards are available from Elktronics at 12536 T.R.77, Findlay OH 45840, telephone (419) 422-8206, for $79 ppd. Circuit boards for the above are available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118 for $20 plus $1.50 shipping and handling. Programmed EPROMS are available in small quantities from the author.

Future boards will include a receiver and bandpass filter, an improved amplifier, an upmixer to complete the HF coverage, and an SSB generator. Others planned include a fully digital front panel, a tracking signal generator, 6m and 2m transverters, and perhaps a different DDS board.

For more information, or if you've designed a board you'd like to tie into the TW-1, write to me at either of the following addresses:

jjw@seastar.org
or
John Welch
1307 N. Richmond Rd. Apt H
McHenry IL 60050
USA

73

Parts List

Item	Quantity	Reference	Part
1	1	C1	1 μF 16V electrolytic
2	1	C2	0.1 μF ceramic
3	2	D1,D2	1N4001
4	1	J1	Header 25X2
5	1	J2	12 volts in
6	30	RP1,RP2	20k 1/8 watt (10k-20k OK)
7	1	U1	LM7805
8	5	U2,U3,U4,U5,U6	27C256
9	6	U7,U8,U9,U10,U11,U12	74LS283 or 74HC283
10	7	U13,U14	BCD true out thumbwheel switches

Number 7 on your Feedback card

73 Review

by Jim Hovanik N3KHM

Connect Systems, Inc.
2259 Portola Rd.
Ventura CA 93003
Telephone:(800) 545-1349
Price Class: $349 (suggested list)

The CS-800

Connect System Inc.'s Full Duplex Interconnect.

The CS-800 Full Duplex Interconnect is both a phone patch and a repeater controller/maker. When connected to a repeater, it can perform the basic repeater control functions and/or phone patch functions. When connected to a dual-band radio, it has the ability to make the dual-band radio a "legal" one-way crossband repeater and/or allow for phone patch functions. It is not designed for simplex operation.

The CS-800 provides all of the required controls for repeater operation. You set the CW identification, the identification time interval, the hang time, the time-out timer, and the courtesy beep CW character. The repeater can be turned on or off remotely via DTMF tones.

The CS-800 also provides a slew of phone patch functions and options. The unit is capable of tone or pulse dialing. There are nine programmable speed-dial memories. The phone patch can be operated either full-duplex or semi-duplex. When in the semi-duplex mode, the mobile side of the conversation is not transmitted. Instead, beeps are sent over the air while the mobile is transmitting. This allows for a little privacy. You also set the activity timer, the time-out timer, and the identification options. It is possible to block the dialing of numbers over 10 digits in length. This prohibits dialing numbers out of the local area code. Four prefix restrictions are also available. Restrictions can be any number or combinations of numbers, such as 1, 0, 976, etc. Two access codes for the phone patch are available. One of the access codes can be set to override the toll and prefix dialing restrictions. Manual dialing can be disabled. With manual dialing disabled, dialing is limited to those numbers stored in the nine speed-dial memories.

An optional plug-in relay is available. It can be activated remotely and can be configured as either a normally open or normally closed switch. Some radios need this relay to key the transmitter.

Installation

The manual does a good job of explaining the installation, setup, and programming instructions. You must have some technical skill and ability to install this unit. *[Editor's Note: See the factory postscript at the end of this review for more information.]*

The Audio-In must be connected to either the discriminator output or the high side of the receiver's volume control.

A COS (Carrier Operated Squelch) input is required. It must be connected to a point that has a voltage swing when a signal is received. You may choose to use your radio's CTCSS decode ability; just connect the COS to the logical output that goes either high or low when the properly encoded signal is received.

The Audio-Out will connect to the mike-high line.

The PTT connects to the transmitter's PTT line. It sends the PTT line to ground through a transistor. If your transmitter is keyed differently, the optional auxiliary relay will furnish a relay closure to key your transmitter.

The power requirement of the CS-800 is 12 volts at 300 mA. It is reverse polarity protected and has a low voltage sensor that will shut the unit off if the voltage drops too low. This protects the EEPROM's programming.

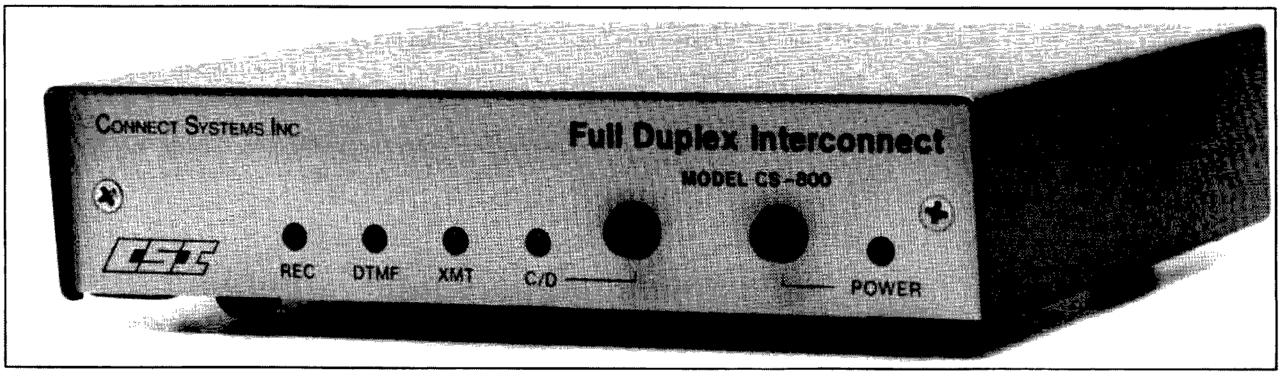
There are level adjustment pots for the mobile-to-land level, land-to-mobile level, DTMF level, status tones levels, CW ID levels, COS threshold level, and repeater audio. There is also a hybrid alignment procedure that lessens the feedback when using the full-duplex phone patch with a full-duplex rig. The instructions are clear and easy to follow.

Inside the cover is a keypad and a two-digit LED display. They are used to program the unit. The manual's programming instructions are easy to follow, and when you are done, the program is saved in the EEPROM. The LED display also shows the DTMF tones as they are received and decoded.

The Law

Although the CS-800 was made primarily for commercial use, it can be put to good use in the amateur service. There are features in this unit that, if used or used improperly, would be illegal on the amateur bands. It is your responsibility to see that the specific application and use is legal.

Many of the newer dual-band rigs offer crossband repeater operation. However, without a three-minute timer, or automatic station identification every 10 minutes, the legality of using these rigs as repeaters has been questioned. The CS-800 will allow you to operate a legal one-way crossband repeater by providing for all the required automatic controls. There is also a question as to whether a dual-band 2 meter/440 radio used for phone



patching is an auxiliary station. If it is an auxiliary station, you must transmit to it on the specific frequencies allowed by Part 97 of the FCC rules.

If you are setting up a repeater operation, consider setting up your frequencies with the local repeater coordinator.

User Observations

My CS-800 is connected to an Alinco DR-570T 2 meter/440 dual-band radio. The Audio-In is connected to the high side of the volume control. The COS is connected to the CTCSS decode board. A home-brewed rotary switch box allows the radio's mike input and PTT to be connected to either the CS-800, a TNC, or the hand mike.

Whenever I am done using the DR-570T on packet or for a QSO, I set the two VFOs and the rotary switch to the preset phone patch settings. Then I just have to remember to turn on the system before I leave the house.

The hybrid circuitry does a good job of reducing feedback when working a full-duplex phone patch using a full-duplex mobile. Most people say that it sounds like I am on a cordless phone. Working the patch with a dual-band handie-talkie is a little tricky because of feedback. If you can turn off the HT's full-duplex mode, the feedback will be eliminated and it will operate as if you were using a repeater phone patch. You can also use an earphone with the HT and retain the full-duplex convenience.

I have used the repeater function with my dual-band radios. As expected, it performs well, but feedback is a problem. The only way to eliminate the feedback is to turn off the radio's full-duplex feature or to use an earphone. The repeater option can be used to uplink to a distant repeater that you can hear, but not reach with an HT. Keep in mind that mobile radios are not made to be repeaters. They will burn out if run at full power for long periods.

Conclusions

My CS-800 has been in use for two years and has not had a single problem. I purchased it so that I didn't have to use the local repeater for phone patches when I was near my home. I wanted the insurance of having a second patch available both for personal emergencies and for when I'm involved in local emergency management. Using your own phone patch gives you a little more privacy than using the local repeater, and working full-duplex is so much better than semi-duplex that most people on the other end don't even realize you are on a phone patch unless you tell them. From my town there is only one repeater with autopatch capabilities that can be accessed with an HT. Boy was I glad I had the CS-800 when that system went off the air for a year and a half while it changed locations!

While the CS-800 has served me well at emergencies, most of my phone patches are to other hams for short QSOs.

[Factory Postscript: Sometime after the author purchased his unit, instructions were added to give the user a choice of connecting the CS-800 internally or externally. The author has described the internal connection method. When the external connection method is used, the only connections made to your dual-band radio are to the mike and speaker jacks, which can be accomplished with minimal technical skill. When connected externally, the CS-800 operates correctly as a Full Duplex Interconnect, but the repeater controller mode will not operate. Most amateur installations use the external connection method for ease of installation and because the repeater controller is not used in most installations.]

Number 8 on your Feedback card

73 Review

by Michael Bryce WB8VGE

The Ten-Tec Scout

Easy, affordable and best of all, fun!

Ten-Tec
1185 Dolly Parton Parkway
Sevierville TN 37862
Telephone: (800) 833-7373
Fax (615) 428-4483
Price Class: $495

Since the introduction of the microprocessor into ham radio, we've seen the size of our transceivers go down. At the same time, we also have seen the complexity of their operation go through the roof. Is there an affordable blend of microprocessor technology and simple easy-to-use circuitry available?

Well, yes there is. It's called the Scout and it's made by the folks at Ten-Tec. Ten-Tec calls it their model 555. The Scout is a small transceiver with a microprocessor mated with time-proven analog circuits. The entire package is affordable, even for the ham with a slim budget. And talk about easy to use! Getting on the air when you're new to ham radio can sometimes be a real Maalox moment. That's not the case with the Scout. It's made to be simple to use, and that's especially pleasing to the new ham. Old-timers will like the ease of use, too.

An Introduction

The receiver has a superhet design using an IF of 6.144 MHz. The Scout's superhet receiver is single-conversion. Receiver sensitivity is 0.35 µV for 10 dB @ 2.5 kHz bandwidth. The dynamic range is 85 dB @ 2.5 kHz bandwidth.

Monoband operation with plug-in modules allows you to cover all the ham bands. That's operation from 160 meters through 10 meters. There is some overshoot on all bands. A large 0.56" four-digit LED display has 100 Hz resolution. The actual transmitted CW signal is 750 Hz below the display frequency on 160, 80, 40 and 30 meters. The transmitted CW frequency is 750 Hz above the displayed frequency on the higher bands. The display will show you the receive signal's frequency minus the MHz digit. That digit is printed on the front of each module. The microprocessor has no control over the output of the VFO, except for the Frequency Lock System, or FLS. The microprocessor adds features to the Scout, while analog circuits provide the muscle.

The optional noise blanker takes care of ignition noise while you're hamming down the road. The patented "Jones" filter is front-panel-adjustable from 500 Hz to 2.5 kHz. Full CW QSK, a Ten-Tec tradition, and push-to-talk SSB round out the features.

The Scout provides a solid 50 watts of RF output to the antenna while drawing a scant 10 amps from a 13.8 volt power supply. If the cigar lighter in your automobile will handle the current, and some of them won't, you can power the Scout directly from it. On receive, the Scout requires 600 mA. The Scout can be tilted up by the bail handle. The entire package weighs in at only 5 lb. 3 oz.

A Closer Look at the Scout

The Scout is a mix of both old technology and the high-tech stuff of today. The VFO used by the Scout is a permeability-tuned oscillator, or PTO. Ten-Tec has been using these for years in their many transceivers, such as the Argosy line and the Corsair line. This time around the Scout has a new wrinkle with the Frequency Lock System.

The Scout uses a *RISC*, or Reduced Instruction Set Computer, to control several main functions of the Scout. It takes care of the LED display, and emulates a Curtis type B iambic keyer with adjustable speed from 5 to 50 wpm. You can tell Ten-Tec has always been a CW operator's rig; the default speed is 25 wpm. When you put the SPEED-RIT switch in the speed position, the current keyer speed comes out on the display. To change the speed, you hit the DAH paddle to decrease speed or hit the DIT paddle to increase the speed. The speed changes one word per minute for each dit or dah. Since there is no internal back-up battery, any speed changes will be lost at power down and the speed will be reset at 25 wpm every time you turn on the Scout.

The Frequency Lock System

The largest task for the computer is the FLS. The Frequency Lock System is complex, so I'll try and explain it in as simple a concept as I can.

The main VFO is a permeability-tuned oscillator, or PTO. The oscillator covers 2.2 to 2.7 MHz, with some overlapping on the band edges.

When you finish tuning a signal, the microprocessor waits for approximately two seconds before allowing the system to lock. This allows the operator to make fine adjustments to the frequency without the microprocessor thinking it's drifting, and correcting. The frequency reading is then stored in a register for reference. The microprocessor compares each new reading with the reference reading and if the difference is in excess of a preset amount, it automatically corrects the PTO by means of a varactor diode. The theoretical stability is to +/- 10 Hz compared with the frequency counter reading.

Since RIT is used intentionally to make small frequency corrections, a circuit was added to detect any movement of the RIT control and shut off the lock feature. This is indicated in the display by the right-hand decimal point being lit when the system is not locked.

The maximum amount of drift correction is approximately +/- 600 Hz. The drift correction system is reset when any tuning is done or if the power is turned off and then back on.

If frequency drift is within 10 Hz of the previ-

Photo A. The Ten-Tec Scout. Simple, affordable and fun.

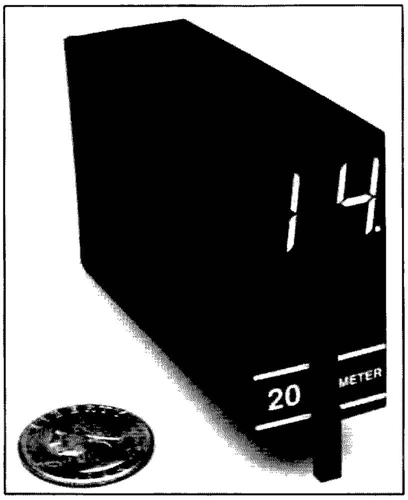


Photo B. A band module. One module of your choice comes with the rig.

ous reading, there is no correction. If it is greater than 10 Hz but less than 40 Hz, the microprocessor will correct. Readings are taken every 200 ms. If the reading is outside the +/- 40 Hz window, the microprocessor assumes you are tuning and will reset the window.

In SSB transmit, the frequency correction works as it does in receive. CW operation is more complex. If the internal keyer is being used, it will take preference over any other operation. There will be no correction during CW transmit but, since it is a QSK system, corrections are made between characters, words and any other pauses. To minimize error when transmitting CW, the correction window is increased from +/- 40 Hz to +/- 100 Hz. When the transmission is over, the frequency is compared to the reference, and if less than 100 Hz, is corrected. After the correction, the window is reset to the +/- 40 Hz value.

The Manual

Ten-Tec has always had great manuals with all of their products. The manual for the Scout is no exception. It contains a description of every control and every jack on the rig. A complete circuit description of each and every module making up the Scout is also inside the manual. This is very handy for fixing the rig should the need arise. What? Fix your own rig? Yes, it is very possible and easier than you think. If you have a problem with the Scout, a phone call to Ten-Tec's service department may be able to step you though to find a bad board. Ten-Tec will send you a replacement board in exchange for your defective board on a 30-day billing invoice. You remove the suspect board amd return it to Ten-Tec for full credit. If that won't fix the problem, then send the complete unit to Ten-Tec. Their service is legendary.

Using the Scout on the Air

When you first look at the Scout, you'll notice something strange: The lack of control knobs! Best of all, you don't have to wade through several displays of menus either. That's because the Scout is built to be simple to use! If you already have an antenna up, and a source of power, you can have the Scout up and running in as little as five minutes.

There is no band switch. To change a band, you remove the band module and replace it with another one. Just like that, your monobander just changed bands. I did not see any explanation in the manual about powering down to change the band modules, but it would be a good idea. On the other hand, I've just pulled one out and swapped in another one with the power on. Nothing happened, so I guess it's ali right to do. There is a small lever on each module so you can pull it out of the case. Of course, the module mounts up front, next to the display.

The modules contain the low-pass filters for their particular band and the mixer/crystal oscillator to convert the PTO to the correct local oscillator frequency. There is also a 3 MHz

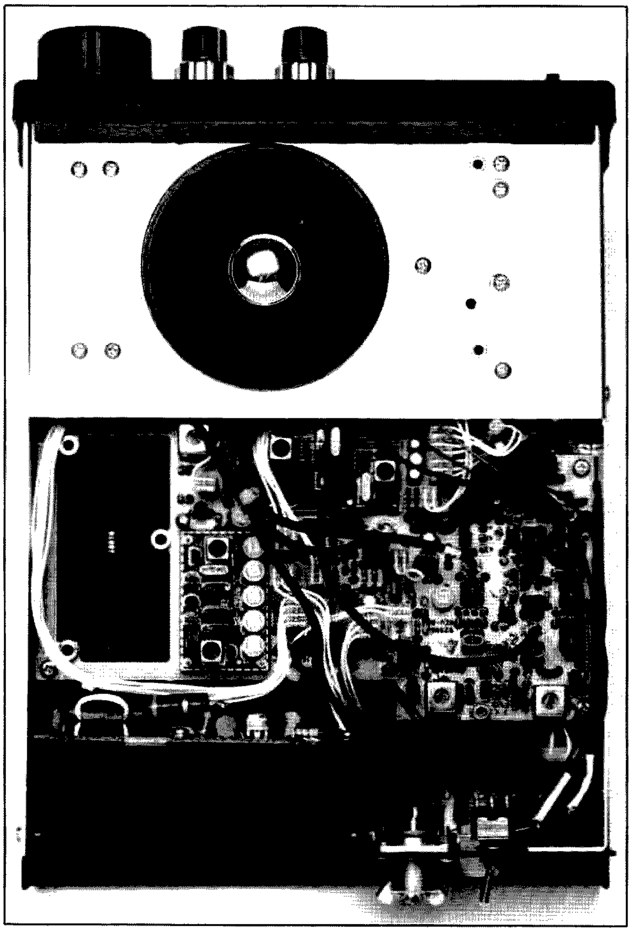


Photo C. Inside view of the Scout. The noise blanker is not installed in the unit. Notice the PA and its heat sink mounted out of harm's way.

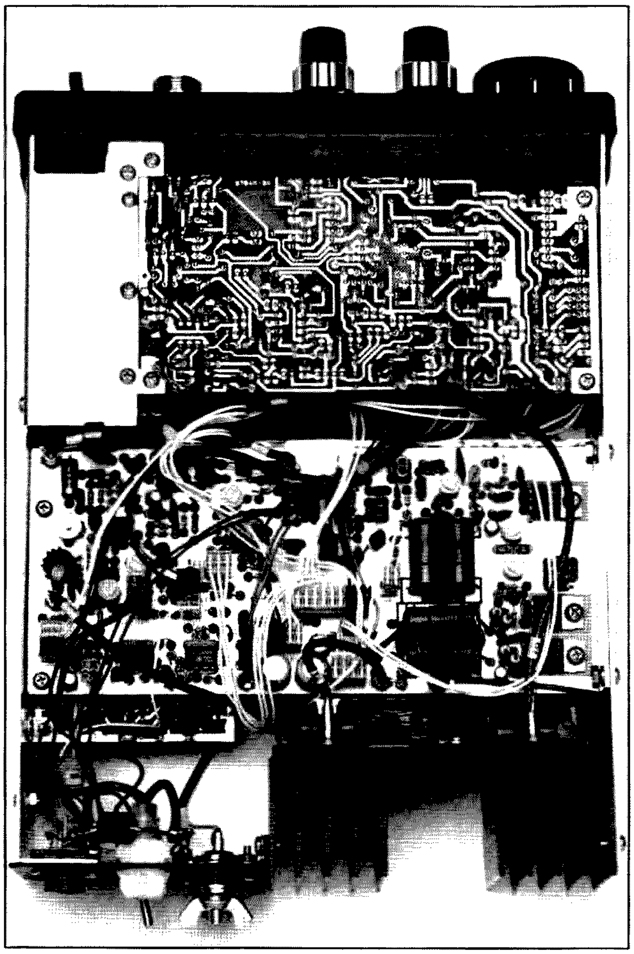


Photo D. Bottom view showing the low-level driver stage and PA.

low-pass filter in each module to keep the 50 watts of RF out of the PTO circuits. A coaxial jack and plug arrangement route the RF in and out, while an edge-card-type plug and jack connect the rest of the circuitry to the Scout. Each module is about the size of a pack of cigarettes. One module of your choice comes with the Scout. Extra modules are $25 each.

You'll need a power source capable of at least 10 amps to fire up the Scout. Ten-Tec makes two different power supplies for the Scout in case you don't have one: A linear model and a high-efficiency switcher weighing only three pounds.

A standard SO-239 antenna socket is used to connect your antenna to the Scout. The analog meter measures RF power and SWR. You flip a switch on the back of the Scout to read SWR, otherwise you set it to read forward power. The tune switch places the rig in transmit and reduces the RF output to 15 watts. You don't need to worry about calibrating the meter, it's done for you automatically.

You tune the Scout with the main tuning knob. The tuning is stiff, *and it's suppose to be that way.* You're moving a slug in and out of a coil. You won't find a finger spinner hole on this knob. The stiffness is kinda nice when bouncing around mobile—the VFO won't be accidentally bounced off frequency by a rough ride. There are no memories to mess with or dual VFOs to get you into trouble (like operating out of band as so many of us did a while back).

Of course, you can turn the RIT on (the RIT has +/- 1 kHz of range) and fine-tune a station, and you can use the variable bandwidth filter to cut out QRM. This is especially helpful during CW. You can set the Jones filter to just the right amount of filtering required by band conditions. There is no RF gain control on the Scout. There's plenty of receive audio from the Scout, even with its small internal speaker. You can use an external speaker or headphones, too. A front panel 1/4" stereo jack allows you to use your walkthing headphones with the Scout. To use my mono headphone with the Scout I had to insert the plug halfway to cut off the internal speaker, or all the way to have audio in both the internal speaker and headphones at the same time.

There is no sideband select switch either. That's done for you automatically. The Scout selects lower sideband on 160 through 40 meters and upper sideband on the rest of the bands.

If you want to operate CW you close your key, or you can use the built-in keyer. The sidetone level is adjustable (from an access hole on the bottom of the Scout), but not the pitch. The access hole requires a fine jeweler's screwdriver and a very steady hand. If some SSB grabs you, you push the microphone button. The only adjustment is the setting of the microphone gain control. Adjust it so the LED flashes on voice peaks. There is no mode control.

I like to listen to CW with the filters wider than most people do. This is very easy to do with the Jones filter and the Scout. But, if you have the filter too wide and a strong signal is in the bandpass, the AGC will be controlled by the stronger signal. The fix is simple: Just tighten up the bandpass of the receiver. A simple turn of a knob is all it takes.

The internal keyer requires a 1/8" plug and the microphone requires a four-pin connector. Both are supplied by Ten-Tec. It's interesting to note that Ten-Tec has supplied all the Radio Shack part numbers for various plugs and adapters. That's a nice touch and It makes life easier for the new operator, too.

Impressions

The receiver in the Scout holds up quite well on the air. Granted, if you connect the Scout to a large super antenna and then compare it to something out of the same price range, you will be able to tell the difference. I used one of the pre-production Scouts during this year's Field Day, and had no complaints about the receiver. Yes, it did get swamped from the other stations we had set up, but they all got hit just as bad.

With 50 watts of RF, you're only 1/2 S-unit below that of a 100 watt rig. The difference between 50 watts and 100 watts is only 3 dB. An S-unit is defined as 6 dB. You'll have no trouble making and keeping a QSO with the power of the Scout. Under bad band conditions, sometimes 100 watts won't cut it, either. You can get the Scout in a QRP version for about $26 less, but I don't recommend it for a first-time ham. While God knows QRP is great fun, beginners in ham radio should have the benefit of 50 watts to get their feet wet. You can turn down the power of the Scout to QRP levels, but you'll end up losing transmitter efficiency.

Unsolicited comments from stations complemented the transmit audio on SSB. I used the hand-held Ten-Tec microphone for SSB. Microphone input is 200 to 100k ohms and it accepts microphones with 5 mV output. The microphone jack will also supply a low-voltage, low-current source for electrets.

I used the Scout on AMTOR with good results. It's more than stable to use just about any digital mode. I did not try RTTY. Since the heat sink gets very warm, almost hot on long-winded SSB QSOs, running full key down would require some sort of extra cooling, like a small fan. Be advised, though, that the Scout's main purpose in life is CW and SSB. Running digital modes is quite possible with the Scout, but you'll need to keep the PA heat sink cool. Since the Scout selects the proper sideband for phone use, I had to adjust the software I used to invert the receive signal and the transmit as well. Most digital modes are done on lower sideband.

And, of course, what can you say about Ten-Tec's legendary QSK for CW? I operated with both the internal keyer and an external keyer. The sidetone is a pleasant 750 Hz, to match the offset during transmit.

The Scout is really at home in your car running HF mobile. A mobile mounting bracket is available. The noise blanker works very well with ignition-type noise pulses, I highly recommend this option for mobile use. Using less than perfect mobile antennas, I have been able to work states all over the country. Most don't believe me when I tell them I'm running only 50 watts mobile.

The Scout is also happy sitting on your operating table. While it's true, the Scout does not have all the bells and whistles of some of the other rigs in use today, it will still give you quite a lot of operating pleasure. The Scout is especially appealing to the new ham on a tight budget. One or two band modules (you get one with the Scout) would be all you need. The most popular modules are 40, 30, and 20 meters.

It's not a contest rig, and it was never designed to be one. However, I plan to put the Scout though this up-and-coming CQ World Wide DX contest this October. I did use the Scout on the QRP ARCI CW contest with excellent results.

The Scout would be an ideal *second* rig also. You could throw it under your arm, grab the microphone with the other hand, and set up an emergency communication center in minutes.

What really took me by surprise while doing this review was a comment my wife made. With a basement full of radios and other electronic equipment, she said, "Why, I might even be able to operate this one. I don't think I could break it if I did something wrong." That's an interesting point. You can't do anything wrong that will hurt the Scout. There are no memories to overwrite, no dual VFO to worry about, and no complex multi-function knobs either. I could just see Donna sitting down in front of an IC-781. All I'd be saying would be: "Don't touch this knob, don't touch that, and watch out for this, but don't worry about that one."

So, no matter where you are, be it camping, tooling down the road, at Field Day, or operating from home, the Scout will provide you with a lot of fun. In fact, I had such a good time with the Scout, Ten-Tec won't be getting this one back. I bought it!

Overall, I think Ten-Tec summed it up the best: "The Scout is easy, affordable and best of all, fun!"

The FOXBOX

A voice ID T-hunt controller

by Rex Drake KI5GH

Do you need a simple, effective controller for use during foxhunts? I wanted such a device, but was unable to find one that fit my desires. Most controller circuits use some form of PROM chip, which I did not want to use. I did find a controller circuit[1] that used 8-bit shift registers to form a programmable memory. To get the required number of programmable bits to create the memory, the device needs 16 register chips. Buying this many chips could become expensive and the device still can only operate in CW.

I was browsing through the local Radio Shack and found a chip which intrigued me. The ISD1000A is billed as a voice record and playback IC. Even though the chip is somewhat expensive, the price is roughly equal to, or slightly cheaper than, buying a PROM or buying 16-shift register chips. The ISD1000A can be used to identify a hidden transmitter with *voice*, or in CW like the other controller circuits I discovered.

The ID Circuit

The ISD1000A comes packaged with application notes[2]. I made a few changes to the "simple record and playback" circuit. The chip has an addressable memory. I decided to use the memory to store a single message—so the addressing circuitry was not used. I obtained the microphone recommended by the application notes. The notes and the mike data differ slightly in the circuits required to power the electret mike. The data included with the mike described a simpler circuit than that included in the notes. I used the simpler approach and have encountered no problems. My final modifications were made to the speaker output of the ISD1000A. I inserted a 1k potentiometer (R11) which can be used to adjust the audio level sent to the transmitter. I also included a 1:1 audio transformer to provide isolation between the ISD1000A and the transmitter. Other than these changes, I built the circuit as described in the notes.

The Timer Circuits

Two timers are required for the FOXBOX. I used a 556 dual-timer IC to reduce the circuit size. The chip includes two separate 555

timers. Timer 1 controls the overall time period of the FOXBOX. The timer is used in the astable mode to provide a continuous repeating cycle. At the end of every timer cycle, the ID circuit is activated. The time period is adjustable by use of a potentiometer for R4. The cycle adjusts between approximately 30 and 90 seconds. A 1 megohm pot, used for R4, will allow for timer periods up to approximately 200 or 300 seconds.

The second timer is used to control the time the transmitter is held in the transmit mode. Timer 2 operates in the monostable mode. A trigger signal is needed to start the timer cycle, which runs for a set time period. The trigger signal is provided by Timer 1 at the end of each of its cycles. Timer 2's cycle adjusts via R1, providing a period of 10 to 25 seconds. The adjustable period allows keying of the transmitter only as long as the ID message lasts.

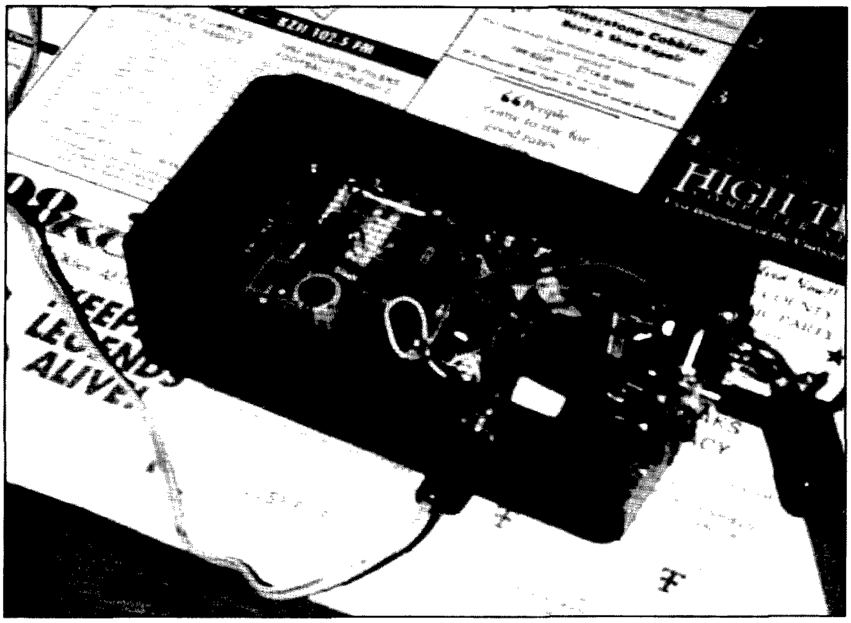


Photo A. The assembled prototype showing the external switches and connections.

Keying Circuit

I built several radio keying circuits before I found one which works reliably in this application. I wanted to be able to key several different radios with the circuit. Therefore, the circuit could not be built specifically for any particular radio. One of the requirements I had for this device was the electrical isolation of the timer from the radio's press-to-talk (PTT) circuitry. I wanted the isolation to prevent current flow between the two circuits. I did not want audio signals interfering with the timer output. When using my HT for the fox, the mike and PTT circuits have to be placed in series.

I solved the keying problem by using an optoisolator. The optoisolator IC contains an infrared LED and an infrared phototransistor. The two components are connected only by an infrared light beam. The isolator's LED is driven by the output of the transmit timer

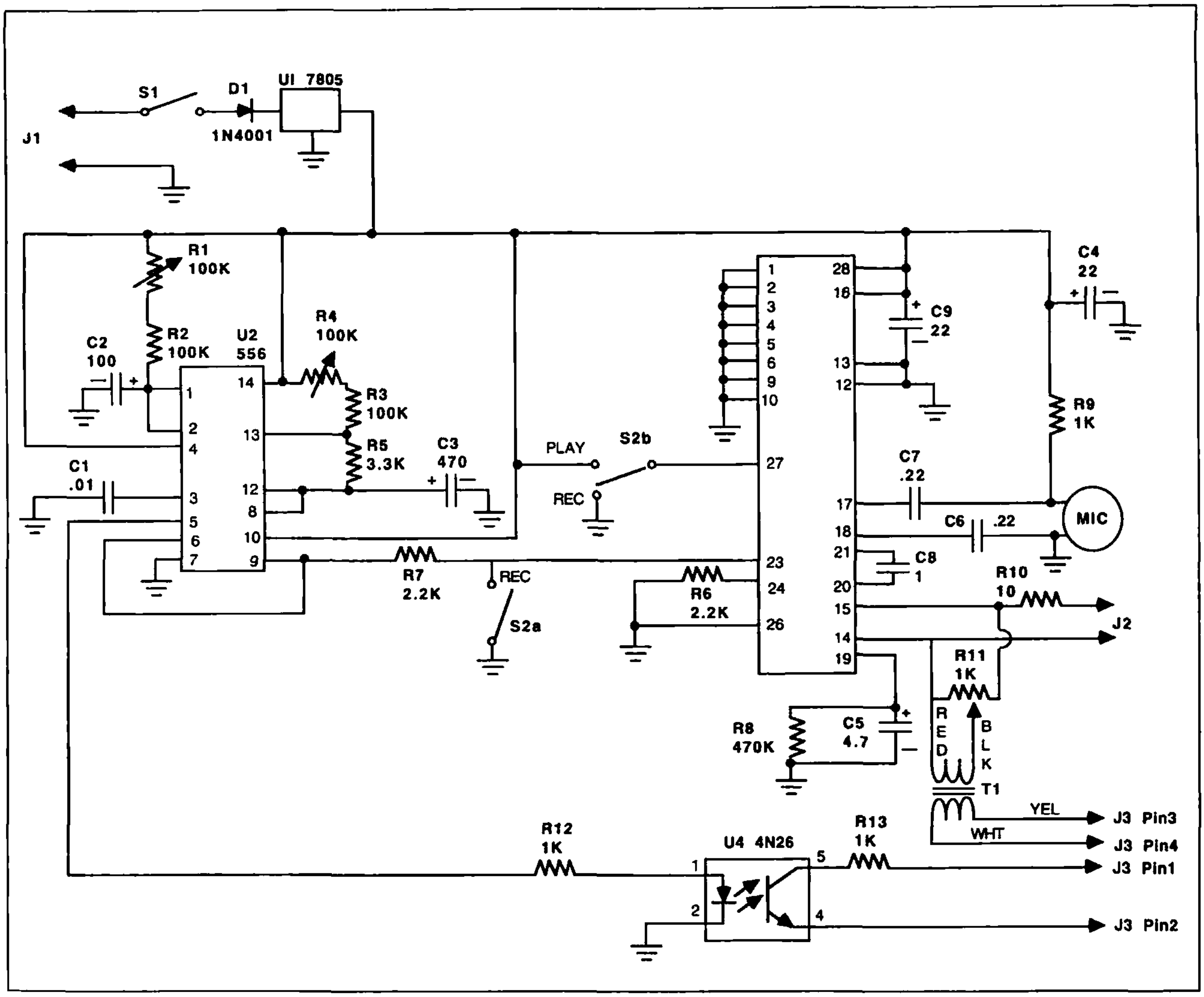


Figure 1. FOXBOX circuit schematic. Notes: All capacitance values in microfarads. For ICOM and similar HTs, short pins 2 and 3 of J3.

(Timer 2). The LED current is limited by R12. When the LED is lit, the phototransistor is turned "on," acting as a PTT switch to key the transmitter. R13 limits the current from the radio's PTT circuit to avoid destroying the phototransistor. The resistor value may need adjustment to allow reliable keying of some rigs. Ohm's Law can be used to calculate R13.

Let R equal the value of R13. V is the voltage measured at the radio's PTT pin. I is the maximum current desired to flow through R13. Try to set the current at about 20 mA. *Do not* let the current become greater than 100 mA or the optoisolator could be destroyed.

The optoisolator I used is not available at Radio Shack. To build a FOXBOX entirely from Radio Shack parts, a small 5V relay (#275-240) can be substituted for U4. R12, and R13. The relay coil is connected directly to the output of Timer 2. The relay's normally open (NO) contacts can then be used for the PTT switch.

FOXBOX Power

The FOXBOX is designed to operate from 8V to 12V battery power. The circuitry actually operates at 5V. A 7805 voltage regulator (U1) is used to achieve the nec-

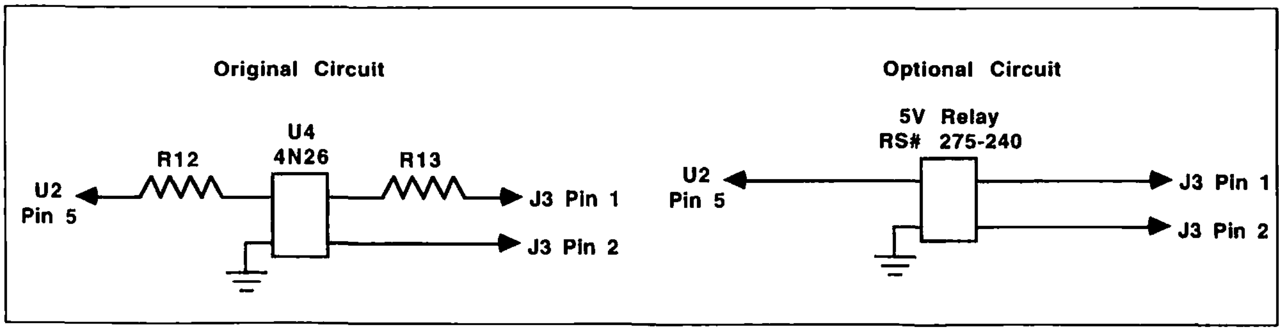


Figure 2. Original and optional keying circuits for the FOXBOX.

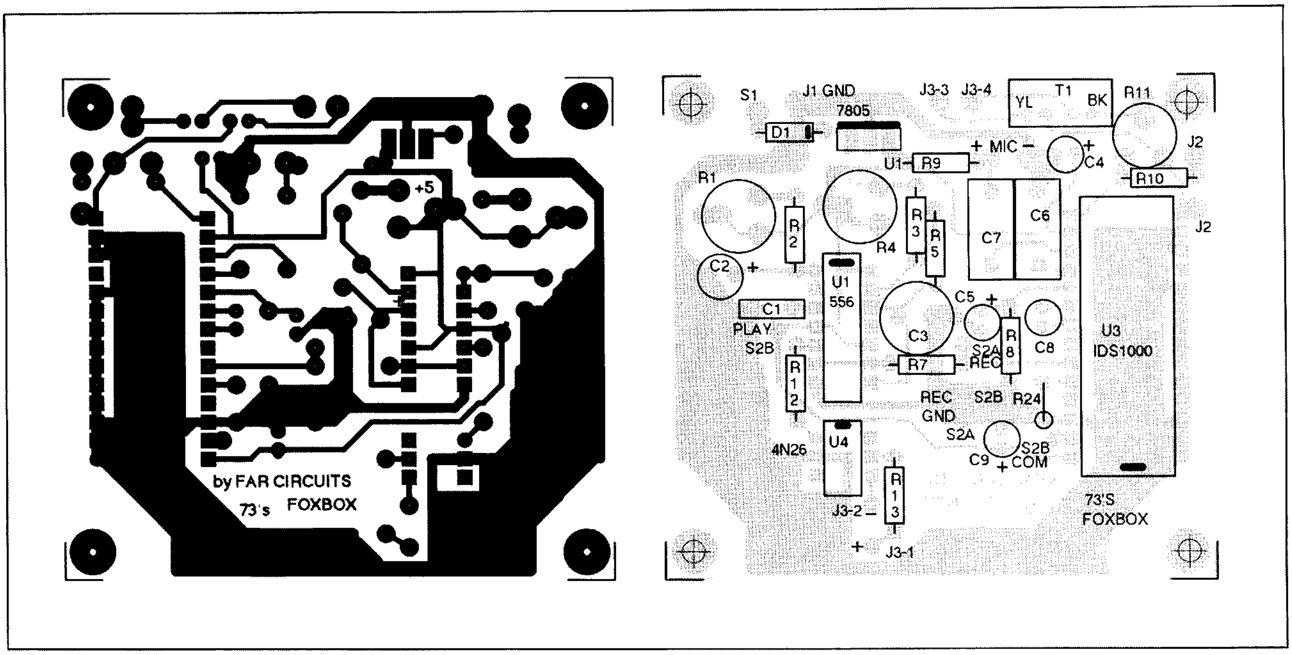


Figure 3. PC board pattern and parts placement.

essary 5 volts. No filtering capacitors are used, due to the DC input. Reverse polarity protection is provided by a 1N4001 rectifier diode.

Construction

The entire device was constructed on a breadboard in order to debug the individual circuits before actual construction. After debugging, I built the prototype on a 3" by 4" piece of perfboard. Perfboard construction requires careful attention to correct wiring connections. A printed circuit board would be

Pin Assignments for J3

Pin #	Function
1	PTT
2	PTT Ground
3	Mike
4	Mike Ground

Note: For use with ICOM or similar handhelds, jumper pins 2 and 3 together in the interface cable plug.

helpful for preventing wiring mistakes.

I mounted most of the components on the top side of the circuit board. The three adjustable resistors and the microphone were mounted on the underside of the board. The underside mounting is due to the board's location close to the inside of the case. I drilled three holes in the case in order to allow for timer and mike level adjustments to be made externally just before hiding the fox. A fourth hole was made to allow direct access to the microphone.

I chose to use a readily available ABS plastic case, even though it offers no RF shielding. To date, I have not experienced any problems with RF interference.

For hiding, I wanted to use a piece of large-diameter PVC pipe to house the FOXBOX and transmitter. The pipe would help with disguising the fox and would also provide protection to the devices inside. Because the FOXBOX was to be placed in the pipe, I wanted all of the external jacks and

Continued on page 50

Parts List

Part	Description	RS Part #
U1	7805 5V regulator	276-1770
U2	556 dual timer	276-1728
	14-pin IC socket	276-1999
U3	ISD1000	276-1325
	28-pin IC socket	276-1997
U4	4N26 optoisolator	*Mouser #570-4N26
	8-pin IC socket	276-1995
R1,R4	100k PC mount pot.	271-284
R2,R3	100k	271-1347
R5	3.3k	271-1328
R6,R7	2.2k	271-1325
R8	470k	271-1354
R9,R12,R13	1k	271-1321
R10	10	271-1301
R11	1k PC mount pot.	271-280
C1	0.01 µF	272-131
C2	100 µF	272-1028
C3	470 µF	272-957
C4,C9	22 µF	272-1026
C5	4.7 µF	272-1024
C6,C7	0.22 µF	272-1070
C8	1 µF	272-996
D1	1N4001 rectifier	276-1101
T1	1:1 audio transformer	273-1374
S1,S2	Mini DPDT slide switch	275-407
J1	Power input	274-1563 or preference
J2	1/8" speaker jack	274-248
J3	5-pin DIN jack	274-006 or preference
Microphone	Electret type	270-090
Optional:		
Perfboard		276-162 or 276-168
Case	Size to fit	
Relay	5V SPDT micro	275-240

Note: The relay, if used, would replace U4, R12, and R13. See text.

A drilled and etched PC board for this project is available for $4.25 plus $1.50 S&H from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

The Fox Box

Continued from page 47

switches at one end of the case. I achieved the placement goal with one exception: I did not leave enough room on the end of the timer case to place the jack for an external monitoring speaker. Placing the jack on the side of the case caused only a minor problem because the speaker would not be used when the FOXBOX was hidden. Careful attention should allow all jacks and switches to be placed on the end of the case.

Connectors and Switches

Three external connection jacks and two switches are used for the FOXBOX. For the power jack, I chose a coaxial power connector identical to the one used by my ICOM HT. The speaker uses a standard 1/8-inch phono jack. I chose to use a 5-pin DIN plug for interfacing the radio. Any 4-or-more-pin jack would have worked well here. The DIN plug was the least expensive option explored.

I wanted the switches to be low-profile slide switches. A DPDT switch is required for playback/record selection. An SPDT switch is required for power. I used two small DPDT switches because they were easily availabile.

Operation

Operating the FOXBOX is straightforward. Apply 8 to 12 VDC, then put the play/record switch (S2) into the RECORD position. Speak at a normal level into the microphone to record a message up to approximately 20 seconds long. The message *must not* be long enough to entirely fill U3's memory or message playback may not occur properly. At the end of the message, place S2 back in the PLAY position. The newly recorded message will now play back once at the end of every cycle of Timer I.

An interface cable is required between the FOXBOX and the hidden transmitter. I want to be able to use two different radios for the hidden T. The first radio, an Alinco 570 uses a four-conductor interface cable to carry PTT, PTT ground, MIC, and MIC ground signals. The second radio, an ICOM O2-AT handheld, only needs a two-conductor cable. To use the HT, the MIC signal from the FOXBOX is placed in series with the PTT ground connection.

I had originally intended to use a third switch in the FOXBOX to accomplish the series MIC connection for HT use. I decided not to use the switch and instead just shorted the appropriate pins in the interface cable connector. The decision to eliminate the switch saves the space required to mount the switch on the case.

Conclusions

Designing and building the FOXBOX was quite fun. If the relay keying circuit is counted, I achieved my goal of building the device entirely of parts available at any Radio Shack store. Future improvements to the FOXBOX could include filters for the audio output. Addressing circuitry could be used to allow the record and playback of several short messages by the ISD1000A. The FOXBOX will serve well to control many types of hidden transmitters. If the FOX is to be hidden for a long period of time, provide plenty of battery capacity for the transmitter. The FOXBOX itself draws only a small amount of power so large batteries are not needed. Creative housings for the entire FOXBOX package will allow limitless hiding possibilities. Let the imagination fly.

References:

1. Moell, Joseph D., KØOV, and Thomas N. Curlee WB6UZZ. *Transmitter Hunting: Radio Direction Finding Simpified.* Blue Ridge Summit: Tab Books, 1987, p. 193.

2. Tandy Corporation. *ISD1000A Voice Record/Playback IC.* Fort Worth: Tandy Corporation, 1992.

Number 10 on your Feedback card

The Commercial General Radiotelephone Operator License

Pass that test!

by Gordon West WB6NOA

You may remember the FCC's very tough examination for the First Class Radiotelephone Operator License, better known simply as the "1st phone;" the license necessary to work on and adjust broadcast radio equipment. If you worked on two-way radios, you needed the "2nd phone." And if you operated over boat radios that carried passengers for hire, you needed the "3rd class license."

Then the FCC lumped the 1st and 2nd class licenses into one common license called the Commercial General Radiotelephone License, and gave it lifetime status. Then the Commission went on to deregulate the land mobile radio service maintenance laws, and threw out the requirement that fixing this equipment required the GROL (General Radiotelephone Operator License).

But the rules still require that all technicians who repair and adjust marine and aviation radios must have a GROL to work on transmitter sections. The radar endorsement is also necessary if the technician goes inside a ship's radar for internal adjustments.

Meanwhile, the FCC has been hit with cutbacks. The commission was not able to keep up with a current question pool nor a schedule of when the GROL examinations could be offered. In fact, there was a period about a year ago when the FCC would not give an applicant the exam unless that applicant could prove that he or she really needed the license in the first place!

So now it's a whole new ball game—the commercial radiotelephone operator license is fast becoming that coveted "wallpaper" to get. The good news is, the GROL exam has never been easier!

Recently, the FCC released "new" (ha) test questions and appointed nine private organizations to administer the examinations. These private organizations are called Commercial Operator License Examination Managers or "COLEMs." Serving the amateur radio operator who wants to take the new tests is our familiar W5YI VEC group (telephone: 817/461-6443), working as a COLEM under the name "National Radio Examiners Division." Commercial examinations are given by the same team of W5YI examiners who give ham tests, and they very well could offer the GROL test right after the amateur radio tests.

"The COLEM system is similar to the VEC system in that a specified number of questions are selected for the written exami-

nation from a publicly-released pool of questions and multiple choices," comments Fred Maia W5YI. "The National Radio Examiners Division of the W5YI Group is organized into seven testing regions, and we are happy to supply any amateur operator or any test candidate with a list of test center managers."

The Commercial General Radiotelephone License consists of Element 1 questions covering rules and regulations and Element 3 questions covering technical skills. There are 170 questions covering marine radio operator Element 1 rules and regulations, and you must answer correctly at least 18 out of 24 questions from the Element 1 pool.

There are 729 questions found in the commercial Element 3 pool, and you must answer correctly at least 57 out of 76 questions to pass the Element 3 test. And now, here's where it gets interesting for the amateur radio operator . . . the Element 3 technical examination for the Commercial General Radiotelephone License is broken up into eight sub-elements:

1. Operating procedures—three questions
2. Radiowave propagation—three questions
3. Radio practice—five questions
4. Electrical principles—16 questions
5. Circuit components—13 questions
6. Practical circuits—22 questions
7. Signals & emissions—nine questions
8. Antennas & feedlines—five questions

Similar to a ham test, a specific number of questions must be used out of each sub-element. And where did these questions come from? They were submitted by a very few interested parties when the word went out that the FCC was looking for new updated technical questions. In fact, the response was so poor that the Commission needed to come up with hundreds of questions to add to the few questions that were submitted for this pool. And where did they get over 500 questions on the Element 3 question pool? You guessed it. Here is the breakdown:

729 total Element 3 questions
315 taken from amateur Advanced question pool
236 taken from amateur Extra Class question pool

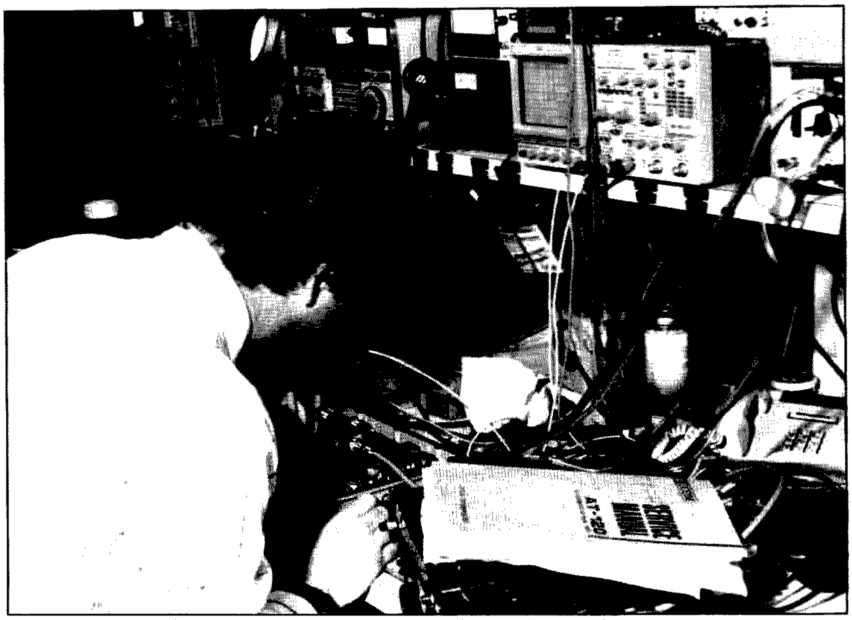


Photo A. It takes a commercial license to work on marine and aviation transmitters.

178 new questions modified from old commercial exams

Hang on, it gets better if you have already studied the Advanced and Extra Class ham question pools—you now know at least two-thirds of what could be asked on the commercial test. Here is the precise breakdown between the commercial questions and the ham question pool:

Commercial Sub-Element	Amateur Radio Sub-Element
3A1-3A5	ADV. 4AB-1.1 - 4AB-1.5
3A6-3A18	XTRA 4BB-1A.1 - 4BB-2A.9
3A19-3A41	New questions.
3B1-3B10	ADV. 4AC-2.1 - 4AC-4.5
3B11-3B14	XTRA 4BC-2.1 - 4BC-3.3
3B15-3B22	New questions.
3C1-3C39	ADV. 4AD-1.1 - 4AD-7.3
3C40-3C51	XTRA 4BD-1A.1 - 4BD-3A.3
3C52-3C97	New questions.
3D1-3D40	ADV. 4AE-1.1 - 4A-8.10
3D41-3D96	XTRA 4BE-1.1 - 4BE-6B.5
3D97-3D115	New questions.
3E1-3E46	ADV. 4AF-1.2 - 4AF-5.5
3E47-3E72	XTRA 4BF-1A.1 - 4BF-5.3
3E73-3E-75	New questions.
3F1-3F72	ADV. 4AG-1.1 - 4AG-9.7
3F73-3F110	XTRA 4BG-1A.1 - 4BG-4B.3
3F111	New question.
3F112-3F130	XTRA 4BG-4B.5 - 4BG-8.2
3F131-3F139	New questions.
3G1-3G58	ADV. 4AH-1.1 - 4AH-10.2
3G59-3G93	XTRA 4BH-1A.1 - 4BH-6A.3
3G94-3G97	New questions.
3H1-3H45	ADV. 4AI-1.1 - 4AI-12.4
3H46-3H76	XTRA 4BI-1A.1 - 4BI-6D.2
3H77-3H143	New questions.

These questions will remain unchanged for at least a year—but when it comes time to revise the Element 1 and 3 questions, you can be assured that most of the amateur-type Element 3 questions will be replaced with some real "brain busters" that will have little or no amateur radio question heritage.

Amateur radio Advanced and Extra Class study guides adequately explain how to solve for two-thirds of the commercial Element 3 questions. The following books could help you get through the "new" questions, plus add tremendous background behind all commercial questions:

General Radiotelephone Operator's License Study Guide, LeBlanc, Tab Books.

Radio Operator's License Manual, Kaufman, Hayden Books.

Practice Tests, GROL Exams, Veley, Tab Books.

Electronic Communication, Shrader, McGraw-Hill.

Land Mobile and Marine Handbook, Noll, WPT Publications.

ARRL Handbook, American Radio Relay League.

The combined Element 1 and Element 3 question-and-answer pool is available for $12.95 from Gordon West Radio School, 2414 College Drive, Costa Mesa CA 92626.

There is more good news for licensed Extra Class amateurs—you have already satisfied the 2nd class radiotelegraph CW Element 1 and 2 requirements, having passed your 20 wpm code test. Extra Class hams who have passed the ham 20 wpm requirements won't need to take the 16 wpm groups/20 wpm text tests.

Soon the Commission will release the question pool for ship radar endorsement, Element 8. They will also release the question pools for radio operator and radio maintainer licenses to operate satellite radio systems aboard U.S. flag vessels.

So if you are a technical ham and are looking for one more piece of "wallpaper" to put up at the shack, consider taking the commercial Element 1 and commercial Element 3 examinations—a total of 100 questions on the combined tests—and earn your Commercial General Radiotelephone ticket. Even though this license is no longer required for the maintenance of land mobile radio gear, it is still a good license to have—it could cover you if you ever need to pop open a marine radio, a radar system, or an aviation transceiver. And with two-thirds of the questions coming straight out of the amateur radio question pool, the time to take the test is RIGHT NOW.

Element 1 (was Element 1 and 2): Basic radio laws and operating requirements: 24 questions out of a 170-question pool.

Element 3: Electronic fundamentals and techniques to adjust and repair marine and aviation radios; 76 questions out of a 729-question pool.

Element 5: Radiotelegraph operating practices; 50 questions out of a 250-question pool.

Element 6: Advanced radiotelegraph operating procedures; 100 questions out of a 500-question pool.

Element 7: Global maritime distress and safety service practices and regulations; 76 questions out of a 360-question pool. The FCC is soliciting this question pool now.

Element 8: Ship radar, technical, theory, and practice; 50 questions out of a 250-question pool. The FCC is soliciting questions now.

Element 9: Global maritime distress and safety service radio maintenance questions; 50 questions, 250-question pool. The FCC is presently looking for input to the question pool. ■

> ***"Hang on, it gets better if you have already studied the Advanced and Extra Class ham question pools—you now know at least two-thirds of what could be asked on the commercial test."***

RTTY LOOP

Number 11 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey M.D., WA3AJR
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Baltimore MD 21208

I've got to start out this month with a vivid memory. One year ago this month, my family joined most of the East Coast in welcoming the Blizzard of '93. This "storm of the century" arrived late on Friday, March 12, 1993, and continued through most of the day on Saturday, March 13. It remains as a vivid memory to my family, as my daughter's Bat Mitzvah was scheduled for that weekend. After two years of planning, studying, and arranging, we had to cope with the unexpected and regroup. She had her Bat Mitzvah three months later, and all came out OK, but that frosty weekend remains as a symbol of the unexpected, and the need to be able to adapt to the situation. After all, isn't that one of the things ham radio prepares us all for? Anyway, just thought I'd share a memory with you, my friends.

CoCo Programs

Keeping with the theme of the unexpected, I received a letter from Ed Barr K2HD of Spring Hill, Florida, who says that he is still fooling around with a Radio Shack Color Computer. He is looking for a copy of the program that we published awhile back for the CoCo.

The program was printed in the January 1988 issue of "RTTY Loop," with a correction prompted by the automated typesetters' garbling of BASIC statements published a few months afterwards. The CoCo SIG on Delphi has carried the programs for many years; I believe they are still there. As with the "RTTY Loop" disks, copies of previous columns are also available, for the same deal: $2 per column and a self-addressed, stamped mailer. You don't need to send paper, though!

Help! CP-1/C-64 Connection?

Another ham toodling around with older equipment is Bill Shimmin W7GBC of Tacoma, Washington. Bill is attempting to get onto computerized digital modes, with an AEA CP-1, Commodore C-64, ICOM 735, and "appropriate software."

He has run into a problem making the connecting cables. The connection between the CP-1 and the C-64 seems to be different, depending on the reference material. One source has the cable going to the joystick port of the C-64, and another says it should go to the user port. So, he is looking for information on which port of the computer should be used, and which pins of the selected port are needed. The CP-1 uses a five-pin connector with TTL levels; he does not have the RS-232 option.

Bill calls these items "relics of a bygone past," and he suspects that this information may be gathering dust in some ancient file. Well, Bill, I would rather say that there are quite a few hams out there using just this setup, and I fully expect to be inundated with information on the proper configurations for the CP-1/C-64 combination. I'll print the best of them in a future column.

Santec HT-1200 on Packet

My sincere thanks to Michael Geier KB1UM who writes the "Ask Kaboom" column here in *73*. He noticed my request for information on putting the Santec HT-1200 onto packet and, having just completed such a modification, sent it along. As soon as I get the time (Isn't that a laugh?), I'll try to do the same. Meanwhile, if there is enough general interest in this, I'll be happy to share the modification with you all in these pages. Just drop me a line and let me know.

Helpful Reference Publications

I often receive requests for information on monitoring digital modes, for frequencies of commercial stations, and the like. One of the finest sources for this information I know is Klingenfuss Publications.

Jorge Klingenfuss has devoted years to producing a series of publications that directly addresses the needs of the RTTY amateur. His *Guide to Utility Radio Stations* is the only international publication to cover some of the latest military and political events, including frequencies in use in the Balkans, Africa, and Asia. Schedules of various transmission type, including facsimile, are all included.

In addition, a *Radioteletype Code Manual* contains detailed descriptions of various radioteletype systems, including Baudot, SITOR/AMTOR, Arabic, Cyrillic, Hebrew, Amharic, Greek, Korean, Thai, Japanese, and more. He even covers non-standard Morse alphabets in Arabic, Cyrillic, Greek, Hebrew, and Japanese.

Weather buffs will appreciate his *Air and Meteor Code Manual*, which contains details for decoding meteorological data from systems in use all over the world, including the Aeronautical Fixed Telecommunication Network (AFTN).

If you are interested, and who wouldn't be, drop Jorge a line at: Klingenfuss Publications, Hagenloher Str. 14, D-72070 Tuebingen, Germany. All of the prices in his catalog are given in deutsche marks, so you will have to check the current conversion rates before you order. Many of his materials are also available in French, as well as in German and English, so be sure to mention that as well if language is an issue. Above all, don't forget to mention that you saw it here, in "RTTY Loop"!

RTTY Software

Many of you have been taking advantage of what must be the best value in software around. The four "RTTY Loop" disk collections feature a veritable plethora (you have no idea how long I have wanted to use that term in a column) of MS-DOS software. Disks #1, #2, and #4 contain amateur radio, RTTY, and packet software; disk #3 contains DOS and Windows utilities for archiving, dearchiving, and viewing software. Each collection exceeds one megabyte in size, almost filling a 3.5" high density (1.44 Mb) diskette. Each one may be yours if you send me a mailer with return postage, and a blank diskette with $2 in US funds for each collection desired. If you would like to receive a listing of programs in each collection, just send me a self-addressed stamped envelope and request the latest listing for the "RTTY Loop" software collection.

More answers to your questions next month, as spring breaks and we all get the urge to clean up the shack. Drop me a note at the above address, or via Email on CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR), or America Online (MarcWA3AJR).

Number 12 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
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Repairing Water-Damaged Ham Gear

Three full days of heavy, hurricane-driven rains pelted the East Coast of the United States. In my county, the Potomac River crested 11 feet above flood stage. In the narrow mountain river canyons of West Virginia, 80 miles upstream, it welled up to a 54-foot-high wall of water that overwhelmed the best efforts of hundreds of bone-tired volunteers. Despite backbreaking heroic efforts, the sandbag wall at the edge of one town gave way under the relentless pressure of an angry river. Over the next 24 hours the water rose, completely flooded basements and gushed into the first floor of most homes and businesses to a height of six feet.

Scenes like these were repeated throughout the mountain and coastal regions of the Southeast. As the waters receded, the governor of one Southeastern state called out the National Guard to prevent looting, and the people returned to their homes to salvage what they could. After cleaning out the poisonous cottonmouth water moccassins that inevitably come along with the flood waters in our Southern states, they found their possessions soaked and mud-caked. Among the damaged goods were many electronic products, including ham gear, which they brought to their local service shops in hopes that something could be salvaged.

Although most flood damage scenarios are not as dramatic as that described above, we nonetheless often hear of ham gear and other electronic equipment that has taken a bath: boating accidents, plumbing failures, basement flooding and a variety of other problems splash equipment out of service. The author recalls one incident where a hospital plumber burst a three-inch-diameter water pipe that he was repairing (in a nursing station workroom). Water came pouring out of the pipe at a high rate, causing a massive flood that damaged patient monitoring equipment in the Operating Room and Post Anesthesia Recovery Room on the floor below. After the smirks died over the public address annoucement "All housekeepers STAT to 2-east," a major effort was undertaken to save nearly $150,000 worth of electronic equipment that was freshwater damaged. Fortunately, there are certain things that a skilled person can do to restore operation.

If the insurance company pays off well enough, then one can go out and buy a new rig. But if the insurance company refuses to pay ("Sorry . . . wind-driven water damage excluded . . ."), or if there is no or insufficient insurance, then you might want to attempt restorative action. Even if the insurance company does pay off, customers can often buy the equipment back from them for salvage value. I recall a guy who received $325 for a two-year-old hand-held 2 meter rig, and then "bought it back" from the insurance company for $20. The company sent him a check for $305, and he kept (and restored) the "carcass."

Restoration Steps

Some of the steps recommended may sound a little bizarre to you from a normal perspective, but they are capable of restoring an expensive piece of equipment. Some of the steps might cause a little damage that will also have to be repaired (especially those involving baking the moisture out, or using chemicals for cleaning). If that makes you nervous, then please remember that in the case described you cannot harm the equipment anymore: IT IS ALREADY A TOTAL LOSS! Any restoration is therefore pure gain; any further damage is no big deal. If you are a professional service technician, before making any wild promises make sure that the customer understands that you are undertaking heroic measures that may not be successful. One of the most frequently cited causes of bitter customer dissatisfaction is not your poor performance, but rather dashed expectations. If your customer is led to believe that the job will turn out much better than is possible, then he or she will not be in a forgiving mood when you fail to catch the bullet in your teeth. But if the job is a lot better than their expectations, then you will probably hear word-of-mouth "advertising" around town about your ability to walk on (or at least get rid of) water.

The first thing to do is refrain from turning the equipment on, even for a brief test to see if it is broken. Satisfy yourself right now that even a short dunk will cause fatal damage! Still, the all-too-natural urge is to see if the equipment survived the flood: IF IT WAS IMMERSED IN WATER, THEN IT DID NOT SURVIVE!

Give It a Bath

The first job is to remove the covers and give the equipment a bath. A shop in a seaport town finds saltwater damage to electronic equipment common. One such shop where I worked in the late 1960s received an $1,800 UHF-FM radiotelephone set (the kind typically used in taxicabs, police cars, fire trucks and ambulances) that had been immersed the night before during a coastal storm. A saltwater river tributary overflowed its banks just high enough to cover the radio mounted in the equipment well of a service vehicle! The first thing the technician did was take the transceiver out on the back parking lot and give it a 10-minute shower with a garden hose. He had lived in that town all his life, and therefore had much experience with saltwater-damaged radio gear. Incidentally, if the damage is due to saltwater, then do the cleaning job immediately. The longer salt residue remains in the equipment, the greater will be the corrosion damage, and the lower the chance of successful restoration.

In some cases, it will be necessary to follow the shower with an immersion bath. One technician uses a 25 gallon washtub, the kind you might use to give a large dog a bath. He mixes together in the tub two to four quarts of a product like Lestoil, a small bottle (2-4 fl.oz.) of either fingernail polish remover or acetone (same chemical) and enough tap water to fill the tub all the way to the rim. Leave the equipment in the bath for an hour, then pour out the solution. Rinse the tub out thoroughly and refill with plain tap water (some people prefer distilled water, which is available in bottles in some areas). This second bath removes the residue left by the chemicals in the first bath. BE CAREFUL OF FUMES! DO THIS JOB OUTDOORS OR IN A WELL-VENTILATED SPACE. NOTE: This bath may damage some plastics. If this worries you, then use plain soapy water. It isn't quite as effective a solvent, but it works somewhat. Keep in mind that most plastic pieces can be replaced, and the damage will not usually prevent the equipment from operating; it is already a total loss, so don't worry about trivial secondary damage!

Dry It Out

The next step is drying the unit out thoroughly. If you live in North Africa or Arizona (Yes, they have floods in the desert! Some of the worst rain storms I've been through were in Tucson!), then simply leave the equipment out in the sun for about a week. Residents of other terrains will have to use some other method. The kitchen oven is a good bet, provided that it can be regulated to maintain a temperature of 125 to 130 degrees Fahrenheit. That range is low for many kitchen ovens, and some might not be able to remain that cool. Higher temperatures will dry the set out faster, but they will also melt some of the plastics used in it, so beware. The drying process takes several days, perhaps as long as a week. Of course, if plastics can be removed before baking, then do so.

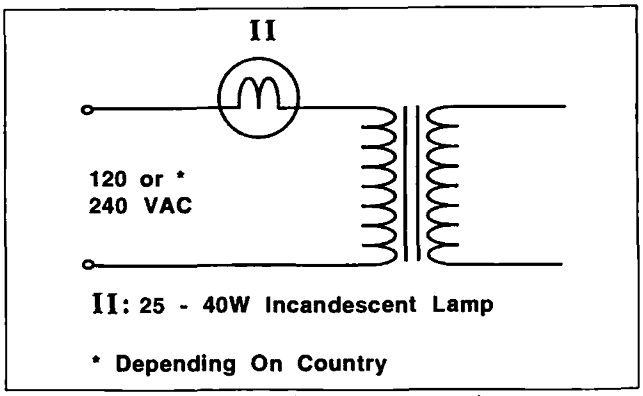

Figure 1. One method for drying a power transformer.

Another alternative is to build a box of cardboard (or other material), and use several hundred watts of incandescent lamps to provide heat. Use a thermometer inside the enclosure to ensure that a) the 130 degree "melt limit" is not exceeded, and b) the box doesn't catch fire from neglect (cardboard burns). Again, up to about a week is needed, although in one case a car radio that was dropped in a freshwater lake for a few minutes dried out in only one day.

Test It

Now comes the BIG TEST!!!! In some cases, the only way to test the equipment is to turn it on and look for smoke. The more conservative approach sneaks up on it one step at a time. The first step in the test is to disconnect the DC power supply; this step can be absolutely essential to the future health of the set being repaired, especially those with high voltage (HV) power supplies. Without connecting the set to AC power, connect a bench power supply to the circuitry that was previously connected to the rig's internal power supply. It is essential that you use a DC power supply that will provide the same voltage(s) as the original internal supply, and additionally (this is important) has a current limiter control. The output voltage is set to the DC voltage normally supplied by the equipment power supply, and the current limiter control is set for a short-circuit current only a little above the normal operating current of the circuit under test.

Why go to such trouble? The reason is prevention of secondary damage. There is almost inevitably a short circuit or other condition that draws loads of current. If such a condition exists in the equipment, then the internal power supply normally used probably produces enough current to burn up components, printed wiring board

tracks and other components. After the circuit is checked out, then check out the power supply and (if working) reconnect it.

The low-voltage DC power supply should be checked out separately, especially if it uses a series-pass regulator (most equipment does these days). If the voltage regulator circuit is not working, then several possible faults allow the rectifier output to be connected to the regulator output; this occurs when the series-pass transistor is either shorted or hard biased to full turn-on. Since the rectifier voltage is always higher than the regulator output voltage, it can damage circuits that were just pronounced healthy.

High voltage DC power supplies have special problems all their own. These supplies are common in CRO video monitors, TV sets, as well as high power radio equipment. Small amounts of moisture that are no problem in low voltage supplies will permanently damage an HV supply. The special problem is the HV transformer. If moisture has penetrated the transformer, then the unit may have to be replaced. It may help to provide some extra drying for the transformer, but be prepared to replace it. Figure 1 shows a method for drying a power transformer. A low wattage AC lamp in series with the primary of the HV transformer is used to generate internal heat to the transformer. The current flow is enough to cause internal heat build up, but not enough to cause additional damage to the equipment if it is shorted. Keep the lamp on for a total of about a week, although as with all electrical situations, monitor it to prevent fire.

Some remaining areas of concern (and probable damage) are those components where moisture can get in and remain hidden. Candidates include: trimmer capacitors, air variable capacitors, IF and RF transformers, switches and potentiometers, paper capacitors and electrolytic capacitors. Where high voltages are used, such as in RF power amplifiers, it may be necessary to pull variable capacitors and clean the plates and bearings individually. Residue that may be unimportant in lower power, lower voltage, situations can be a real problem at 1,800 volts. With regard to trimmer capacitors, we can open the capacitor up to the minimum capacity position (screw all the way out) and apply a hair dryer or incandescent lamp for 10 or 15 minutes. Whether or not this step is needed can be determined after the initial power-on test shows a specific problem. Otherwise, you will destroy the alignment of the set for nothing. This step should not, therefore, be used merely as a matter of course; use it only in response to a specific symptom. Similarly, air variable capacitors may have corroded contact wipers between the rotor and stator, and this will be apparent when the rig is turned on.

Paper and electrolytic capacitors can absorb water, especially if they have a fiber or cardboard end cap. If the capacitor shows signs of being soggy, then replace it; capacitors are, after all, relatively low cost items.

If there remains a lot of scum on the printed wiring board, then spray clean it with an environmentally safe solvent. Some professional technicians prefer to use a small paint brush or "cheese cloth" to help remove the material. Flood damaged ham equipment is often salvageable. The methods described above have been used by professional service technicians for a lot of years and have proven successful.

More Cleaning Hints

Recently the author heard from a reader who added some advice of his own. He was a former Navy officer who used to have electronics technicians working for him on board a naval ship. He said they used to repair salt-water-soaked electronic equipment in an unusual manner. A sailor would take the equipment into the shower, and slosh it down with warm water. They then took the desalinated equipment to the galley ("kitchen" to landlubbers) and dried it out in the ovens with low heat and good air circulation. The retired officer also advised that distilled water is best, and that tap water in some locations is too hard (i.e. contains minerals); anyone using this method must either buy distilled water or use an in-line water softener. For a chassis covered with oily dirt, the equipment can be cleaned with a mixture of 8-10 ounces of household ammonia, 4-6 ounces of a cleaner such as Mr. Clean or Lysol, 4-6 ounces of acetone (the ingrediant in some fingernail polish removers), and enough distilled (or soft) water to make one gallon of solution. The equipment is dunked into this mess. For larger equipment, proportionally larger amounts can be used. An old dental "Water Pik" can be used to hose off equipment that is too large to dunk. The equipment is then dried in an oven set to 140 to 150 degrees Fahrenheit (Note: Some plastics used in electronic equipment will melt at temperatures over 130 degrees, so beware) for four to five hours. All lubricants in switches, potentiometers and air variable capacitors (where used) must be replaced after this treatment. The black asphalt-like paste that oozes out of overheated transformers can be easily removed from chassis by using either freeze spray, or a blast from a CO_2 fire extinguisher (use an under-pressure one that already needs refilling, don't waste your protection on cleaning jobs). The frozen paste becomes brittle and can be flaked off using a dental tool or soldering aid tool. 73

HOMING IN

Radio Direction Finding

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The Foxcopter

Who says hams don't build anything nowadays? Although few home experimenters take on powerful transmitter or sensitive receiver projects, lots of us are willing to warm up the iron for simple gizmos such as battery chargers and audio filters. Nothing makes you feel more like a member of the traditional ham community than pointing with pride to a piece of gear and saying "I made it!"

Radio Direction Finding (RDF) enthusiasts (sometimes called T-hunters or foxhunters) often get started by building their own mobile VHF quad antennas, RF attenuators, and external S-meter boxes. Sometimes they have so much fun building them that they are inspired to start more ambitious projects.

"Homing In" features on the rotating antennas and cathode ray tube displays of KK6CU (October and November 1992) and KA6SOX and KK6OS (November 1993) have inspired many RDFers, including Bill Rupp NØMKJ of Pewaukee, Wisconsin. "I really enjoy reading about and building the creative equipment that people have come up with for foxhunting," he says.

Bill submitted some photos of his motorized quad RDF system, showing the results of his creative mechanical engineering and parts scrounging. He mounted it on a frame in the bed of his pickup truck (Photo A). The five-element quad (Photo B) is his own design, based on formulas in the *ARRL Antenna Compendium, Volume 1.*

"When constructing the quad I used arrow nocks to hold the wires firmly in place under tension," says Bill. "I use 5/16-inch diameter wood dowels for shafts and a 25-cent pencil sharpener to shape the dowel ends for the nock. This allows me to adjust the length of the shafts very closely. I originally had 2 x 2 lumber for the boom, but I now use a one-inch-diameter Fiberglas tube, which is much more rugged.

"I built the support frame out of one-inch angle iron purchased at a local Farm and Fleet store. The frame is welded in much the same configuration as KK6CU's. I use a four-foot Fiberglas rod, one inch in diameter, for the mast. I got the pillow blocks for $12 each from the local Grainger dealer (Photo C)."

"I picked up a 12 volt DC drive motor from American Scientific and Surplus (3605 Howard Street, Skokie IL 60076). It was intended to be a downrigger motor on a boat. It's marine quality with stainless steel throughout, all for 20 bucks (Photo D). I had to drive the antenna shaft with cogged belts because the motor has 15-tooth XL gears. I picked up 36-tooth cogs for the mast from McMaster-Carr Supply Company. That gives me a rotation rate of 40 RPM."

McMaster-Carr is a large industrial supplier headquartered near Los Angeles, with branch warehouses in the East and Midwest. The company's thick catalog is available to qualified customers by calling (310) 692-5911.

"Rotary coax connectors don't have to be home-brew or expensive," Bill adds. "I found one in the McMaster-Carr catalog for $20, part number 7631K42 (Photo E). It has two conductors with separate mercury pools for low noise. If you order one, be sure to order the matching connectors, part numbers 7631K47 and 7631K48. They are cheap and very hard to find elsewhere."

For the sine-cosine potentiometer azimuth sensor, Bill chose the model PS-340 from Servo Systems, Incorporated, which costs $19.50. He reports that Servo Systems' minimum order is now $50, so it's a good idea to arrange a group buy with other T-hunters. Whereas KK6CU put his sine-cosine pot at the bottom of the mast and the RF slip rings above it, NØMKJ did the opposite (Photo F).

"I disassembled the sine-cosine pot and knocked out the pin that holds the shaft to the wipers," says Bill. "The wipers then just slid off. I replaced the shaft with 1/4-inch tubing, doubled up inside for strength. To mount the rotary coax connector, I just added the next two larger sizes of tubing on the end. The coax could then be fished through the shaft."

An inexpensive Astron 200 watt 12 VDC-to-110 VAC inverter powers NØMKJ's storage oscilloscope display unit, which is configured for easy installation and removal (Photo G). "I've got all the electronics attached to the scope," he says. "After the hunt, I pick up the scope and pull the whole assembly out, unplugging it from the inverter in the back of the King Cab."

Frigid Foxhunting Fun

While many general-interest ham clubs sponsor hidden transmitter hunts, the Milwaukee area is unusual because it has one club devoted entirely to T-hunting. "My first ham radio foxhunt was when I was in the Air Force in Minot, North Dakota," says NØMKJ. "When I came here and found that there was an RDF club, I really got hooked."

The Milwaukee Fox Hunting Club has been active for more than 12 years, with hunts every three weeks. Hunts start at 7:30 p.m. Fridays, and are scheduled to last 90 minutes. Boundaries are 15 miles from the starting point, which is declared in ad-

Photo A. His friends call it the "Foxcopter," but it never leaves the ground. Bill Rupp NØMKJ adapted a design of JaMi Smith KK6CU and built this motorized quad antenna for mobile RDF. (Photos by NØMKJ.)

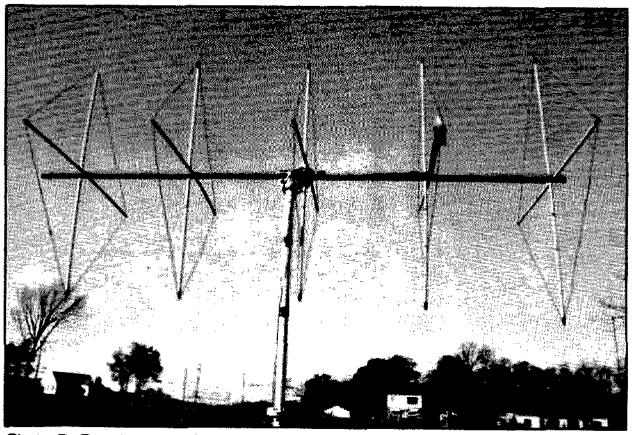

Photo B. For sharp bearings, NØMKJ uses a five-element 2 meter cubical quad. The steel bracket holding the boom to the mast is sold as a product for making boat cover frames.

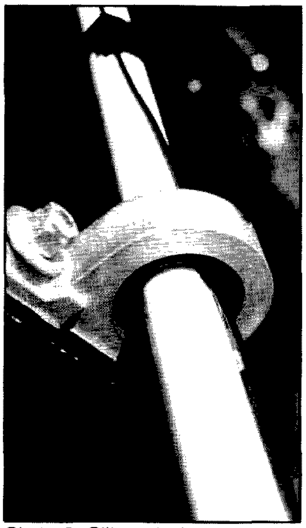

Photo C. Pillow blocks support the mast and provide low-drag rotation. Note the notch for passing the RG-174 coax.

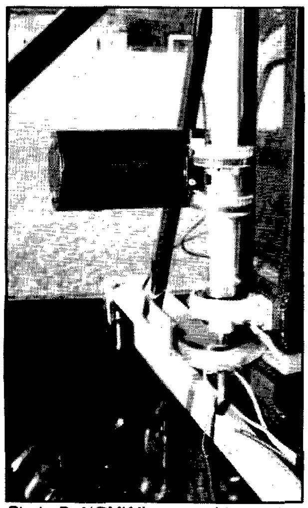

Photo D. NØMKJ's motor drive system uses two cogged belts for balance and reliability. Below the bottom pillow block are the sine-cosine potentiometer and coax connector.

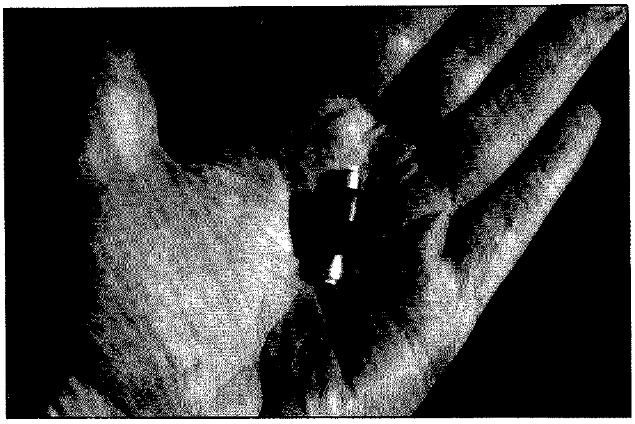

Photo E. Bill is holding an inexpensive rotary coax connector that can be mounted either horizontally or vertically.

vance by the hider. Having different start points allows for variety and opens up fresh territory.

The hidden transmitter on 146.43 MHz must have distinctive audio and be on for 15 seconds per transmission, with 45 seconds between transmissions. The first team to find the T and report on the separate call-in frequency wins the hunt and hides three weeks later.

In addition to after-hunt get-togethers, the group meets every Friday for lunch and a discussion of T-hunting topics, technical and otherwise. Hunt rules are regularly reviewed and revised at these sessions. Bernie Gratz WA9BFH publishes the club's newsletter, with hunt results and stories, distributed at hunts and other club events.

It was probably at a luncheon that fellow hunters learned of Bill's motorized RDF system. He says, "The other members of our foxhunting club heard I was building this thing and they labeled it the 'Foxcopter.' I got quite a bit of ribbing, but they don't laugh so much now."

When I asked Bill if the Foxcopter has made him invincible, he laughed and said, "It has proven to be an odds-evener. I'm a newcomer going against guys who have been doing it for 15 years and know all the parks and other nooks and crannies. I now have at least a five-minute advantage over other teams on the driving portion of the hunt. Unfortunately, I can't use it when 'sniffing' away from the truck. I've made it into the fox's area first on many occasions, but I always seem to lose on the foot hunt."

Winter weather doesn't stop the intrepid hunters of Milwaukee, who hunt storm or shine, hot or cold. According to NØMKJ, "We had three inches of snow during our February 1993 hunt, which made for a very interesting (and slippery) time. The transmitter was hidden halfway up a steep embankment that was covered in solid ice."

Bill says his favorite experience as the hider was last January. "It was perfect because there were big flakes of fresh snow covering everything. After we hid the transmitter, snow came down and covered it up. I put decoy footprints everywhere but where the transmitter was."

The sport of T-hunting is rapidly catching on in Wisconsin. NØMKJ reports that there are regular hunts in Racine and Sheboygan. Other readers have reported activities in the Appleton/Green Bay area. According to Bill, there have been discussions of areawide and statewide championship events. Apparently lots of Wisconsin hams agree with NØMKJ when he says, "T-hunting is the most enjoyable thing I've run into in ham radio!"

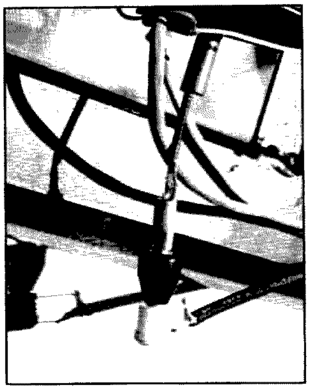

Photo F. The rotary coax connector in place at mast bottom with connectors and coax attached.

Spanning the Globe . . .

Regular "Homing In" readers know that hidden transmitter chasing goes on around the world. In most countries it's done only on foot, as an athletic event similar to orienteering. Interest in European/Asian-style on-foot foxhunting is building here, with more hams telling me they would like to see North American representation at international foxhunt gatherings.

Well, it's time to get busy, because the championship organizers are wait-

ing for us. Lars Nordgren SMØOY tells me via Internet that the seventh Amateur Radio Direction Finding (ARDF) championships are scheduled for September 12 through 17. The Swedish Amateur Radio Society and International Amateur Radio Union (IARU) Region 1 are sponsoring the events, to be held in Loka Brunn, about 190 miles west of Stockholm, Sweden. Hunts for four categories of participants will take place on the 80 and 2 meter bands, in accordance with international ARDF rules.

P. A. Nordwaeger SMOBGU, the Chair of the organizing society, has invited national amateur radio societies around the world to send their best teams. SMØOY, who is responsible for all the courses for the championships, says he expects teams from 25 countries to enter, but his list does not include USA, Canada, or Mexico. That's because there are no national foxhunt committees or championships on our continent, even though the IARU International Secretariat is in the USA.

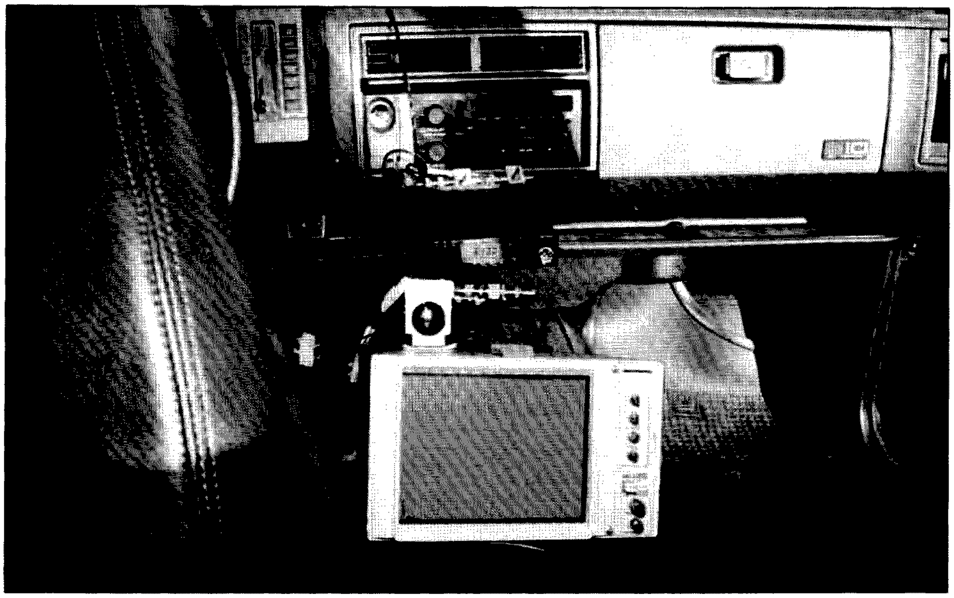

Photo G. Bill's storage oscilloscope readout sits astride the transmission hump and front seat, with RF attenuators mounted to the top.

The deadline for all national societies to submit official entry forms for the ARDF Championships is March 12, so it's too late to form a committee and formally field a team this year. However, Lars indicates that observers and individual participants will be welcome at the Games. Don't worry too much about your command of foreign tongues because English is the official language of the Championships.

If you would like to visit Sweden and participate in the search for the world's greatest foxhunting athletes, send E-mail to SMØOY at his Internet address, ECSLN@kiera.ericsson.se, or write to the ARDF World Championships Secretariat, Grevlingsvegen 59, S-16137 Bromma, Sweden.

"Homing In" will have more information on international championships in future months. Meanwhile, dig out your October 1993 issue of *73 Amateur Radio Today* to learn about the rules and requirements for European/Asian style foxhunting. To help set up a committee for national championships in the USA, write to me at my California address or send E-mail to JoeMoell@cup.portal.com (Internet) or 75236,2165 (CompuServe). My packet address is KØOV@WB6YMH.#SOCA.CA.USA.NOAM.

Number 14 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Twin Wells Indian School Speaks with I.S. 72

Early in the fall of 1993 the kids in my ham radio classes were really excited about a contact we made with children from the Navajo Indian Reservation in Arizona on the CQ All Schools Net. Our initial contact was with a teacher, Gary Ragsdale KB7PXI. Gary's enthusiasm and wonderful way of describing things on the reservation made the children at my end eager to making contacts each week.

It was fun to watch the incredulous looks on my students' faces as they listened to Gary describe their school in Sun Valley, Arizona, as having less than 100 children in grades one through eight. You can appreciate the culture shock when you realize that we have over 1,800 students in our intermediate school in grades six, seven and eight.

After several phone conversations, Gary and I quickly realized the enormous potential for culture sharing that we had. He is busily convincing the administration to allow him to set up a regular scheduled ham radio class at Twin Wells. As of this writing, he must walk the children to his ham shack from whatever class they're in. So far, according to Gary, the administration likes what they see.

After the first radio contact in October, I was delighted to see that some of my 6th graders really got into it by suggesting to me that they be *allowed* to do an extra-credit report about the Navajos. In my classes, I never assign homework. I do encourage the youngsters, however, to do extra-credit projects when something is especially interesting to them. I am always amazed at how well this approach works. I have no doubts that the fact it's a ham radio program we're talking about makes a big difference. What other subject comes close to offering the myriad of adventures and opportunities for exploration that ham radio in a classroom does?

Sharing Experiences

This first group of eager beavers educated the rest of the class with some background about the Navajos, like the fact that the Navajos call themselves "Dine" (pronounced "di-nay"), which derives from the group's traditional Athabaskan language, and can mean both "people of the earth" and "man." The term "Navajo," we learned, has no clear meaning and was bestowed by the Spanish during the period that they claimed control over the 17 million acres that is now Navajo land. One of my 7th graders brought in an article from the local Staten Island newspaper in December titled, "Navajos Want to Change Their 'Foreign' Name." It seems as though the 200,000-member Navajo Nation has begun holding public hearings on a proposal to abandon the term "Navajo" in favor of "Dine." Many older Navajos cannot even pronounce the word, because the "v" sound does not exist in their language.

While my students were busy assimilating all the information they could about their counterparts in Sun Valley, Gary's students were expressing an interest in learning more about the Verrazano Bridge and the Staten Island ferry. Living on the country's largest Indian reservation, which stretches into Arizona, New Mexico and Utah, on over 16 million acres of forests, sand dunes, mountains, mesas and buttes, Gary's kids were of course curious about Manhattan, skyscrapers, bridges and big city life in general. Altitudes range from 4,000 to more than 10,000 feet above sea level on the reservation.

Photo A. Navajo students from Sun Valley, Arizona.

Gary put several of his youngsters on the air with some of mine, and the kids took it from there. The Twin Wells Indian School has provided a Christian education to Native American children for over 31 years. I suggested to the children that we each videotape our respective schools, along with our "ham pal" letters. Students at both ends loved the idea. My kids made a major production out of the video so that their new friends could see what a day in a big New York City school was really like. Everything and everybody got taped. Our entire school soon knew about the project. We videotaped all the shop classes, school assembly programs, gym classes, concerts, and of course the cafeteria.

> **"The whole project took on such an air of fun that even other teachers got caught up in it."**

At the children's suggestion, we collected items that highlighted New York and put together a package before Christmas vacation began. The kids brought in loads of photos of New York attractions, like Radio City Music Hall, the Empire State Building, and the Statue of Liberty. Many children wrote letters and enclosed photos of themselves. We also sent a school sweat shirt along with copies of the school newspaper. The whole project took on such an air of fun that even other teachers got caught up in it. Several teachers would stop by each morning to see what we were doing with the "Navajo Project." They would encourage students in their classes to stop by my room to get an update.

Sample items that children make in our shop classes came pouring in. Children contributed stationery items from our fine graphic arts shop, and beautiful ceramic and stained glass pieces from those shops.

We haven't received Gary's tape yet, but we did get a package of beautiful samples of petrified wood along with a wonderful sample of handcrafted work. He sent us a handcrafted Navajo woman making bread. The details on it are incredible. I keep it on my desk. The kids are fascinated with it.

Both Gary and I are looking forward to a fun and educational year through our radio contacts on the CQ All Schools net. Please join us on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz. Also look for the Educator's Workshop and the Youth Forum at the Dayton Hamvention this April. Stop by and say "hello."

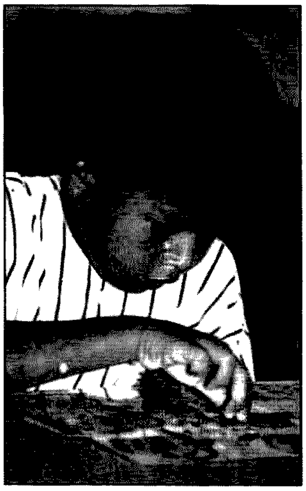

Photo B. Bronson Yazzie.

Photo C. Valvadia Woody.

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

This month, I'll clean up some of the loose ends laying around. But first, the biggest event of the year is very close at hand: the annual Dayton Hamvention, held in Dayton, Ohio. The Dayton Hamvention has become the Mecca for ham radio fans. Every ham should make it to this hamfest once in his lifetime.

Again this year the QRP ARCI club, along with others interested in QRP and low-power ham radio, will be staying at the Days Inn-Dayton South. It's the same place as last year. All those who made the trip in '93 agree it's the best place we have ever been in. Why, even the cockroaches are well-mannered. What really surprised me about this hotel is that it has several ice makers that work! That's a quantum leap from the Belton Inn we used to stay at. There is a swimming pool, sauna, weight room and a very large conference room. We filled this place to standing room only on Saturday night. An excellent (but not cheap) sit-down restaurant is also inside the hotel. If you don't want to eat at the hotel, hamburger alley is right down the road. And, the Dayton Mall is just down the street from the hotel.

It's not as close to the Hamvention as some of the other hotels and motels, but it's not too far down the beaten trail either. Of course, you can (should!) leave your car at the hotel and ride the Hamvention buses to and from Hara Arena, where the Hamvention is held.

The room rate is $70 a night. If we, the QRP ARCI, fill up more than the allotted rooms we have reserved, we may get a price break. Since I'm writing this in the first week of November, I can't say what the final price per night will be, but figure on $70 a night.

If you would like to stay with a bunch of QRPers all under one roof, then you need to send Myron Koyle, 1101 Miles Avenue SW, Canton OH 44710, several items. First, you need to send him two business-sized SASEs. Next, you'll need a check made out to the Days Inn-Dayton South for one night. The last item is a list of who will be staying with you in your room. Don't wait too long. Rooms go quite quickly and there is always a waiting list. You can call Myron at (216) 477-5717. Please, don't call collect.

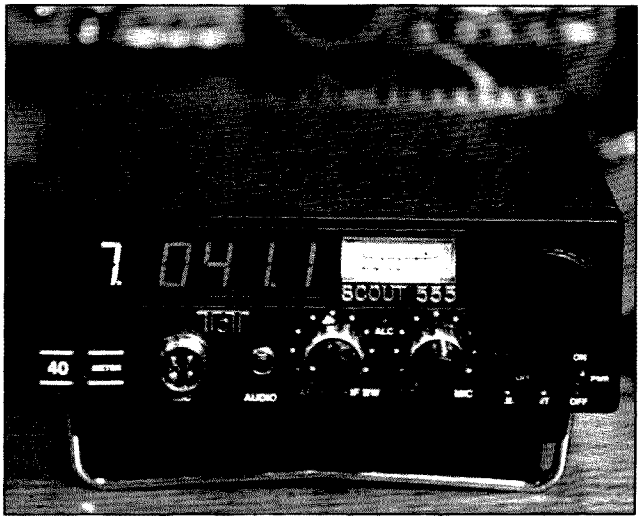

Photo A. Ten-Tec's new Scout getting a shakedown during the fall QRP ARCI contest.

We always have a great time at the Dayton Hamvention. You can meet many of the people behind the calls in the hospitality room. Last year Roy Lewallen W7EL and Wes Hayward W7ZOI stopped by Saturday night. Many of the QRP vendors bring in their newest wares to show in the hospitality room. Last year, Oak Hill Research showed off the new QRP Spirit, S&S Engineering introduced their digitized ARK-40 transceiver, and Bill Hickox had his Tejas RF products on display, too. Of course, the G-QRP club was there as well with their goodies to show. Why, even Mike Bryce WB8VGE showed up hocking his newest solar panels and control systems. There are usually several QRP stations operating at any given time in the hospitality room.

Of course, you don't have to stay at

the Days Inn South to be part of the hospitality group. Drop by anytime during the hamvention, but make plans for Saturday night. It's our biggie. Saturday night is an informal ARCI meeting, pizza party and radio time all in one room. Stop by and join in the story-telling. After all, anytime you're more than 25 miles from home, you're an expert!

Clubs to Join

I listed the QRP ARCI in my "Challenge of QRP" article in the October '93 issue of *73 Amateur Radio Today*. If you want a PR handout about the club, all you need to do is drop me a note with $2 tor shipping to my address above. There is no need to include an SASE. If you want to include one, an address label will speed up your request.

Since QRP is becoming a hot item today, there are several other clubs you may want to join. The Michigan QRP club has been around for a while. Their *Five Watter* is an excellent source of information for the QRPer. Their address is: M-QRP Club, 5346 West Francis Road, Clio MI 48420. Membership is $7 to join and $5 for a club renewal.

The G-QRP, based in England, is also worthwhile to join. It's even easier to join than it was when I became a member. Today you can join the G-QRP club by sending a check or money order for $12 for a new member or $10 for renewal to: Luke Dodds, 2852 Oak Forest, Grapevine TX 76051.

The New England QRP club has grown steadily in the past few years. Their QRP NE newsletter, *72*, is full of reviews of products, club projects and membership news. Their address is: Northeast QRP Club, Membership Manager, Jack Frake NG1G, P.O. Box 1153, Barnard VT 05031. I don't know what the dues are, but a check for $12 should cover it. If not, by all means let me know so I can update all our readers.

I can't find in my piles of paper the mailing address for the Northwest QRP club. Help!

Do you go through more soldering iron tips than QSL cards? If so, you might be interested in *Home-brew: For Amateur Radio Designers and Builders*. If you're interested, contact George DeGrazio WFØK, editor and publisher, P.O. Box 260083 Lakewood CO 80226-0083. For subscriptions and ad orders contact them at 1-800-5-HAM RIG.

If you can make it to Dayton, you can join, renew and inquire about membership in most of the clubs listed. Be sure you stop by and say hello to everyone at the booths.

Kits and More

The Northern California QRP club is also very active, but alas, I don't have an address for them. Anyone know who and how much? Drop me a note with the details. I can tell you their NorCal 40 club kit is very popular. In fact, it has been sold out several times. It's nothing real fancy, but a step up and in the right direction. The receiver is a superhet with an IF of 4.915 MHz. The novel receiver design uses no IF amplifiers. The VFO operates at 2.085 MHz. The audio output is not enough to drive a speaker and the AGC is audio-derived. Even with these limits, it sure beats a sloppily-designed direct conversion receiver.

Photo B. The Howes 30 meter transceiver going together.

The transmitter produces 2 watts of output on 40 meters. You get about 35 to 40 kHz coverage on 40 meters. Tuning is via a single-turn pot, not a variable capacitor. If you want more information about the NorCal 40, contact Jim Cates, 3241 Eastwood Road, Sacramento CA 95821. Don't send me hate mail if the kits are all sold out again.

Looking for crystals for the popular

QRP frequencies, but can't make the minimum order from Bob's Crystal Company? Well, you can pound brass to your heart's content if you order your rocks from Bill Kelsey N8ET, 3521 Spring Lake Drive, Findlay OH 45840. He has a stock of crystals on the popular QRP frequencies for only $5 each. By the way, Bill also stocks Kanga kits, the Techno-Whizzy kit from *73 Amateur Radio Today*, and other QRP goodies as well.

If you're looking for some serious building without spending all your beer money, then how about a 20 meter superhet QRP transceiver for $50? This project comes from the *QRP Quarterly* and was designed by Dave Benson NN1G. It's an NE602-based superhet with 2 watts of RF on 20 meters. I have one I'll be showcasing here in the coming months. You can pick one up from Danny Slevig KA7QJY, Dan's Small Parts and Kits, 1935 South 3rd West #1, Missolula MT 59801; (406) 543-2872. Add $3 shipping for the superhet receiver.

Dan always has a great selection of parts for the home operator. His catalog is just a couple of sheets of paper, but if you build your own gear, you need those sheets! Dan also has several other kits at very good prices. The ever-popular Two-Fer is featured (the version I did in this column). There is no minimum order from Dan's Small Parts.

If you're looking for kits from the ARRL, you might be interested in 624 KITS, 171 Springlake Drive, Spartanburg SC 29302; 1-803-583-1304. Most of their kits are based on the work done by Doug Demaw. I've never assembled any of their kits, but they sound good.

QRP NETS

Net Name	Freq.	Day	UTC
BC Group (SSB)	3.729	Every day	0300/0530
New England QRP	3.855	Monday	0200
North West QRP	10.123	Monday	0200
SEN (QRP ARCI)	7.030	Tuesday	0100
Michigan QRP	3.535	Tuesday	0200
GLN (QRP ARCI)	3.560	Wednesday	0200
GSN (QRP ARCI)	3.560	Wednesday	0200
WSN-80 (QRP ARCI)	3.560	Wednesday	0300
Northeast Illinois	3.560	Thursday	0200
NEN (QRP ARCI)	7.040	Saturday	1300
Northwest QRP	7.035	Saturday	1530
WSN-40 (QRP ARCI)	7.040	Saturday	1700
OK QRP Group	7.060	Sunday	1330
VE QRP	14.0606	Sunday	1800
TSCN (QRP ARCI)	28.332	Sunday	1900
TCN (QRP ARCI)	14.060	Sunday	2300

Townsend Electronics, P.O. Box 415, Princeton IN 46562, handles the Howes kits from England. There are quite a few different kits available from Howes. Drop Jim Townsend a note asking for his latest catalog. I'll have a full review of the Howes 30 meter transceiver in *73 Amateur Radio Today*. Watch for it.

Of course, if you don't want a complete kit, you more than likely can get just the PC board you need from FAR Circuits, 18N640 Field Court, Dundee IL 60118. FAR carries PC boards from just about every project in *QST, CQ, Radio Fun*, and *73 Amateur Radio Today*. All the PC boards FAR makes are made of G-10 Fiberglas and then solder-reflowed. Most of the PC boards have a silk-screened parts overlay on them. FAR Circuits PC boards are first-class all the way.

A&A Engineering, 2531 West LaPalma, Unit K, Anaheim CA 92801, also carries many popular kits for the QRPer. Of note is their popular transceiver for either 20 or 40 meters. This project came from *QST*, October '90 and January '91, and was designed by Gary Breed K9AY. This transceiver works very well indeed.

And, Ten-Tec has introduced a line of kits. I don't have the full details yet on what they offer. I suspect they will be small modules of some sort. Did you know Ten-Tec used to sell only kits? These older kits became the basic PM series of QRP transceivers.

Tejas RF Engineering will be introducing a line of kits to build your own rigs. These will be *building* blocks you can connect together, and should be very popular with QRP builders. All you have to do is interconnect the assembled PC boards into the configuration you require.

Spring ARCI QRP Contest

Take some time off from your building to operate the spring ARCI QRP contest. I won't get into the scoring, as it gets a bit complex. The frequencies are the QRP calling frequencies plus or minus the QRM. Most of the activity is centered on 7.040 MHz and on 14.040 MHz. Also check 7.030 MHz and 14.060 MHz. Check the various magazines for contest days and times.

The exchange is simple. All you need is the RST, QRP ARCI member number and state. If you don't have a number, then you use your power instead. By the way, this is one of the few contests in which everyone is not 5NN!

That's all this month. I will be working the contest off and on, depending on my work schedule. I'll be running a home-brew 40 meter transceiver. We can lie about how great we did when we meet at Dayton '94. See you there!

Number 16 on your Feedback card

PACKET & COMPUTERS

Digital Amateur Radio

Jeffrey Sloman N1EWO
P.O. Box 636
Franklin IN 46131

Getting Started with TCP/IP, Part 6

Well, like some very large percentage of the rest of the US, the flu (I am told it comes from Beijing) struck here. For a week I have been unable to do any substantial work, and as I type this, I am under the weather. Because I don't want to leave you without useful information this month, here are a couple of important files that are used by JNOS—a working AUTOEXEC. NOS file, and a description of how to assign user permissions in the FTPUSERS file. I'll talk more about these next month, but at least you'll have them in front of you, and you can experiment with them until then.

Note that this AUTOEXEC.NOS file may produce errors with certain versions of JNOS, but it should still work. Unfortunately, JNOS does not necessarily maintain compatibility between versions. The differences are usually minor, though. In any of the text files used by JNOS, any line or portion preceded by a pound sign (#) is considered a comment and ignored.

This is pretty much the AUTOEXEC.NOS used here at N1EWO. We will discuss some of the more esoteric entries in future columns. Be sure to use your OWN call and IP address if you try to copy this file!

FTPUSERS

JNOS uses a file called FTPUSERS to assign permissions to the users who connect to your station. The entries in the file are very simple, for example:

n1ewo blort /public 63

where:

n1ewo is the call of the user;

blort is the assigned password (an asterisk (*) indicates that any password should be accepted);

/public is the directory into which the user is placed when making an FTP connection to your station.

The user can then access and directory below, but none above, the specified one; and, finally, 63 is a number indicating the permissions granted to the user. This is a "bitwise" operation and each bit which is turned on in a binary version of the number indicates a granted permission. Don't worry, though, no binary math is required—just add up the numbers corresponding to the permissions you wish to grant from the list below; the result is what you need. I hope you find this information useful. We'll get back to tutorial discussion next month. 73 de N1EWO.

Figure 1

```
attended        on      # Allows TTY link connections
isat    yes     # 286/386 clock
log     yes     # Turns on log (earlier versions
                # need a filename, not "yes"
mbox tmsg "[m  Welcome to N1EWO. [44.48.70.21]  [m"
# This line sets the message that stations see when
telneting
# to your station. It is displayed before the login
prompt.
motd "Congratulations, you've connected."
# This line sets the message that is displayed when
a
# station connects to your ttylink server.
domain cache size 30          # The max number of
resolved addresses
                # that will be cached by JNOS
domain suffix  ampr.org.      # The suffix that will
be appended when
                # none is otherwise provided
domain translate off          # Determines whether
JNOS will try to
                # translate from numerical addresses
to
                # host names. Turning this off can
                # speed things up.
ip address      44.48.70.21     # This host's IP ad-
dress
hostname        n1ewo   # This host's name
ax25 mycall     n1ewo   # This host's AX.25 call
                # MUST precede 'attach'
#--------TNC--------
        attach asy      0x3f8 4 ax25 dsp 2048 256
4800
        # This attaches the TNC to JNOS
        # asy = async (comm port)
        # 0x3f8 = base address
        # 4 = IRQ
        # ax25 = mode
        # dsp = name
        # 2048 = buffer
        # 256 = MTU (Maximum Transmission Unit) like
PACLEN
        # 4800 = port speed in bps
trace dsp 111           # Turns on monitoring for
this
                # interface:    1 = ASCII
                #       1 = input on
                #       1 = output on
#-----------initialize---------
#NOTE:  The TNC must be set to KISS mode for JNOS
#       to work. This is not accomplished in this
file.
#       It can be done manually—with a comm program.
#       most TNCs use the command KISS ON.
param dsp       1 20    # TX delay      (x 10mS)
param dsp       2 63    # Persistence   (0-255)
param dsp       3 10    # Slot Time     (x 10mS)
param dsp       4 10    # TX tail       (x 10mS)
param dsp       5 0     # 0=HDX
param dsp       dtr 1
param dsp       rts 1
#--------SLIP---------
# This section is like the previous attach,
# except that it sets up a SLIP (Serial Line
# Internet Protocol) interface over a wired
# connection. This is used here to connect
# two machines together.
        attach asy      0x2f8 3 SLIP wire 2048 256
4800
        trace wire 111

#-------AX.25--------
# This section sets the AX.25 parameters for the
station
ax25 bcinterval 840
ax25 bctext     "[m  N1EWO mailbox [44.48.70.21]  [m"
ax25 digipeat   dsp on
ax25 irtt       2500
ax25 maxframe   2
ax25 paclen     256
ax25 pthresh    128
ax25 retry      10
ax25 t3 65000
ax25 t4 300
ax25 timertype linear
ax25 version    2
ax25 window     2048
mode dsp        datagram        # Sets the transmis-
sion mode for the
                # dsp interface. Sends TCP/IP in
                # unconnected mode.

#-----inconfig-------
# This section configures the various attached in-
terfaces
#       dsp
ifconfig dsp   broadcast 44.48.255.255
ifconfig dsp   netmask 0xFF000000     # This line
sets the IP mask,
# which determines the addressing class of the sta-
tion. Most amateur
# TCP/IP nets use the mask shown here.
ifconfig dsp   description "Radio port [145.510]"
# This is the
```

Figure 1 (continued)

```
# text description used by JNOS for informational
displays about this
# interface.
#       wire
ifconfig wire  broadcast 44.48.255.255
ifconfig wire  netmask 0xFF000000
ifconfig wire  description "SLIP to 44.48.70.22"
#—TCP/IP defaults—
ip ttl  10       # IP Time-To-Live Parameter
tcp mss 216      # Maximum Segment Size
tcp irtt         65000  # Initial Round Trip Time es-
timate—
# which is used as a guess until the actual time can
be determined.
# If your LAN is very busy and your station seems to
send a bunch of
# retries and then settle down, this number should
probably be higher.
tcp window     216
#——servers——-
# This section starts the various servers built into
JNOS
start  ax25
start  convers
start  finger
start  ftp
start  pop3
start  remote
start  smtp
start  telnet
start  ttylink

#——IP routing——
route addprivate default dsp
route drop 44/8 wire
route add 44.48.70.22 wire
arp publish 44.48.70.22 ax25 nlewo dsp

#———mailbox———
third-party    on     # Allows the BBS to handle
third party mail
smtp   timer 600 # Timer for SMTP polling
smtp usemx     on
smtp mode      route
smtp kick

#———FTP———
ftype  binary
eol    standard
```

Figure 2

	(hex)	
1	0x1	Read files
2	0x2	Create files
4	0x4	Overwrite or Delete files
8	0x8	AX.25 gateway operation from BBS
16	0x10	Telnet gateway operation from BBS
32	0x20	NET/ROM gateway operation from BBS
64	0x40	Remote Sysop access
128	0x80	User is banned from the BBS
1024	0x400	No send command from BBS
2048	0x800	No read command from BBS
4096	0x1000	No third-party mail from BBS
8192	0x2000	User is a BBS
16384	0x4000	Expert User flag
32768	0x8000	No convers command from BBS
65536	0x10000	No escape character from BBS
131072	0x20000	No lists displayed on BBS

ATV

Number 17 on your Feedback card

Ham Television

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ATCO Repeater System

Several members of the ATCO (Amateur Television in Central Ohio) group have recently put together a wide-coverage ATV repeater system (WA8RUT/R). From its vantage point on top of the tallest building in downtown Columbus, the repeater signal has been providing fantastic coverage around the region.

Split-Site Repeater

To overcome the inherent problems with an in-band repeater (439.25 MHz in and 427.25 MHz out), they decided to go with a split-site system. The transmitter is located on top of the State Office Tower (650 feet above street level) and, although the receive site is low profile at the moment, it will soon be located at the 300-foot level of a TV tower about one mile from the transmit site. The two sites are linked together on 910.25 MHz. In essence, there are two crossband repeaters linked together. In fact, several ATVers in the area are using converted license-free transmitters to access the transmit site repeater on 910.25 MHz, some with only a few milliwatts of output power.

The Transmit System

Designed by Ken WA8RUT, the transmit site (see Figure 1) functions as a fully functional crossband repeater with an input on 910.25 MHz and outputs on 427.25 MHz as well as 1258 MHz FM ATV. This versatile system allows ATVers the flexibility of using a variety of modes and frequencies to work through the repeater system. The 427.25 MHz transmitter puts out about 35 watts after going through the VSB filter and goes through a relatively short run of hardline up to the dual-slot omnidirectional horizontally-polarized antenna on top of the building. The 1258 MHz FM transmitter puts out about 18 watts to a single slot (horizontal) antenna. The slot antennas were built by Art WA8RMC.

The 910.25 and 427.25 MHz receive and transmit modules are manufactured by P.C. Electronics and the 1258 MHz FM transmitter is based on a Wyman Research exciter board that runs through a Mitsubishi power amplifier brick. The 910.25 MHz antenna is a 6 dBd gain vertical originally designed for cellular use.

The many functions of the repeater are controlled via a Micro Computer Concepts model VS-100. Touch-Tone commands via 147.45 MHz can control several different video selections, such as a roof camera, weather radar, a bulletin board, and NASA Select Shuttle rebroadcasts.

The Remote Receive Site

Soon to be located about one mile away at a height of 300 feet, this site functions as a crossband repeater with an input of 429.25 MHz and an output on 910.25 MHz (see Figure 2). It uses a horizontal slot antenna for receive (built by Shawn KB8MDE) and a loop yagi to direct the signal at the State Office Building. It contains its own IDer (an Elktronics VDG-1) and will soon have an additional receiver on 1280 FM ATV. When the 1280 FM receiver is installed, the whole repeater system can work as a repeater with 1280 FM in and 1258 FM and 427.25 AM out as well as 429.25 in and both 1258 and 427.25 out. Essentially it will operate as an in-band and crossband repeater on two bands and two modes. If you include the 910.25 MHz link, the system operates on three bands simultaneously. The control logic and tone decoder is being built by Dale WB8CJW.

Shuttlevision Link

Tom KA8ZNY has built up a 910.25 MHz transmitter using a low-power "rabbit transmitter" fed into a power brick to link NASA video into the repeater. He plans on installing a VS-100 repeater controller at his house to allow remote access of the NASA Select video feed from his satellite dish.

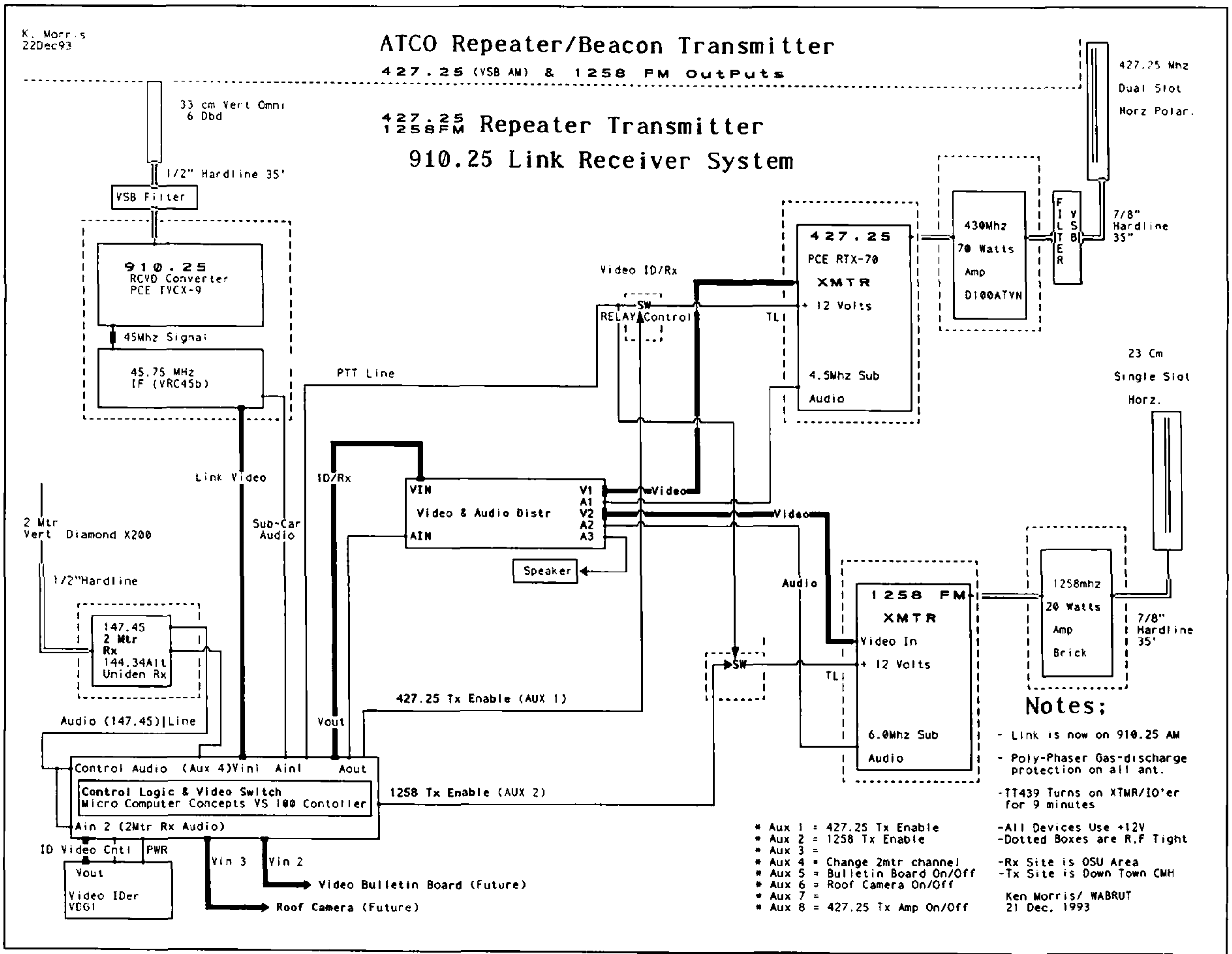

Figure 1. Block diagram showing the ATCO ATV repeater transmit site that is located on top of a 650-foot building in downtown Columbus, Ohio.

During the Hubble rescue mission Tom provided viewers with some spectacular video while testing this linkup.

Weather Radar

Art WA8RMC is currently designing a video capture system and link transmitter to relay the local weather radar image up to the repeater system. The overlay video ID and tone decoder for this system has been built by Charles WB8LGA. The weather radar feed should be operational in the very near future.

Reception Reports

The repeater can be seen p5 (even while mobile) around central Ohio (out to over 20 miles). I've personally seen it in full color on a hand-held portable TV directly tuned below channel 14 from over 15 miles away. Charles WB8LGA has reported consistent p5 in Marengo (35 miles) and can actually view the 1258 MHz FM output at a p2 level using just the LNB input of his satellite receiver (no preamp). Mel KA8LWR sees the repeater at around a p3 level from 56 miles and has seen it several times mobile. Even stations over 80 miles away can frequently see the repeater at a p4 level. The carrier has been heard in Ft. Wayne, Indiana (135 miles), as well.

A number of people (including non-ham observers) are finding it easy to tune in to the action using a cable-ready VCR or a TV tuned to cable channel 58. Some report seeing the repeater using just rabbit ears inside of their apartments.

ATCO Net

If you'd like to find out more about the repeater system or ATV activity in the central Ohio region, listen to the ATCO net every Tuesday evening at 9 p.m. EST on 147.45 MHz (the local ATV calling frequency). The group is quite active, and you can usually find somebody on frequency just about anytime. The other primary ATV calling frequency is on 144.34 MHz and you can find activity there early in the morning (7:30-8:00 AM) and during the evenings. 73

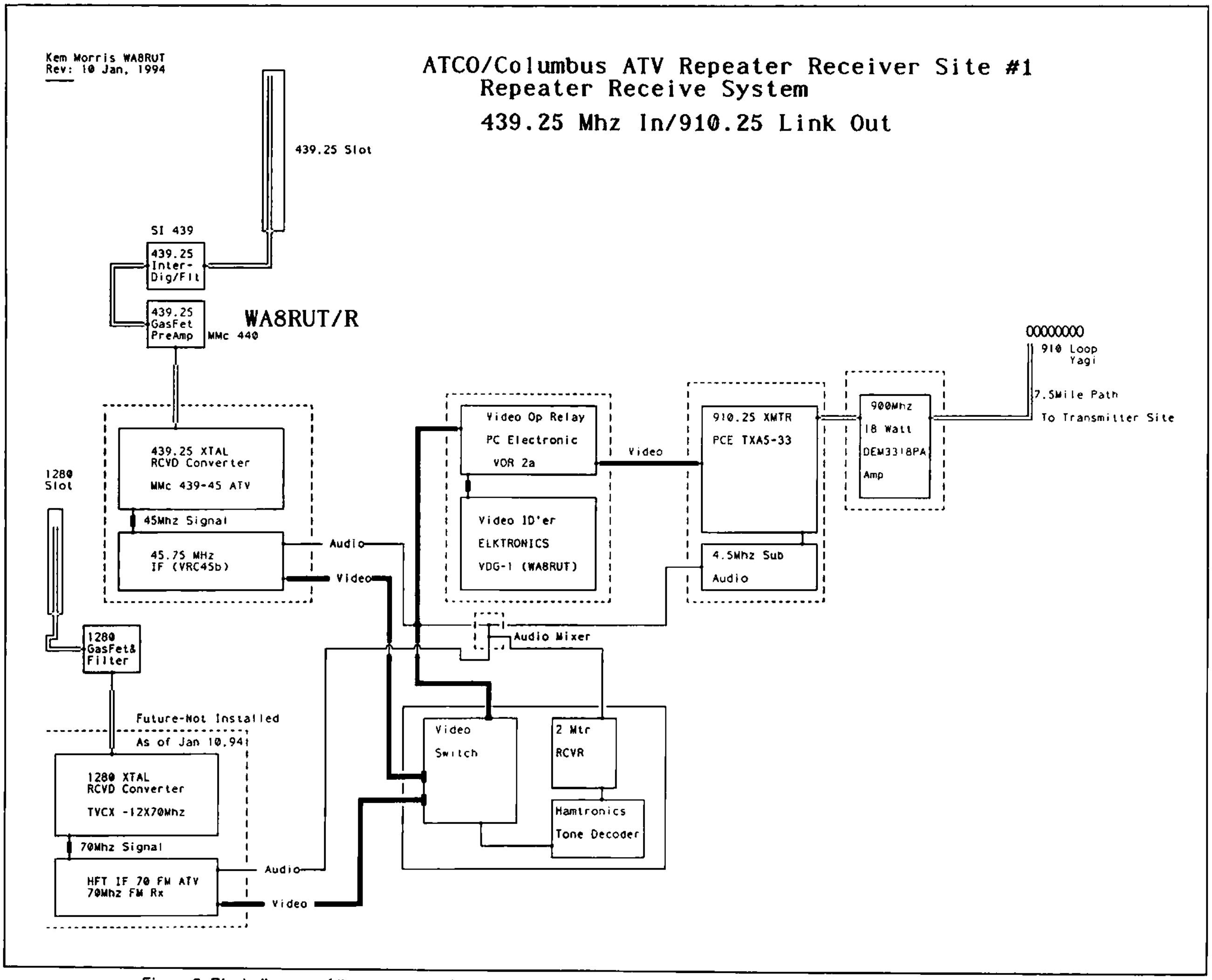

Figure 2. Block diagram of the remote receive site which will soon be located at the 300-foot level of an old commercial TV tower.

Number 18 on your Feedback card

ABOVE & BEYOND

VHF And Above Operation

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Log Amplifiers

This month I want to cover a commercial specialty amplifier called a log amplifier. Last month I covered a homebrew 30 MHz RF preamplifier and some component selection considerations. The preamplifier was intended for use in RF applications for power and low noise receiver or transmitter applications. The log amplifier is similar to the RF type amplifier, with some circuitry changes allowing its output to be handled in a logarithmic fashion. Let's explore this special type of amplifier and cover some amateur radio applications.

A log amp is a multi-stage IF amplifier that has some special circuitry added by design into the amplifier. Basically, the circuitry consists of a diode summing network and output stage. The log amplifier has eight or so stages, with each stage's gain/dynamic range set to 10 dB. The output of each one of these eight or so stages is connected to a diode summing network/limiter. The outputs of these diodes are all tied by common feeding of a video output or associated video amplifier. The output of this video amplifier is the business end of the log amplifier circuit. Additional connections may be made to bring out the standard IF output on the log amplifier, labeled "linear" output. All log amps can be coupled with this output, but not all are.

This makes the amp very usable in both a log function and as a common IF amplifier for a multitude of projects. If used in this case (as an IF amp), it will have a gain of some 70 to 80 dB gain at the amp's specified frequency. Figure 1 shows a block diagram of a typical log amp. Most amplifiers have a preamplifier and a buffer amplifier used to drive six to eight identical stages in tandem. Each stage is set for about 10 dB of dynamic range/gain as determined by circuit parameters.

Trawling for Log Amps

Locating a log amp in surplus can be somewhat misleading. The ones that I have located came disguised inside plug-in type units with shielded cover plates. I suppose they were made to be inserted into a mother board assembly. They look unobtrusive on the outside, having lots of inputs and output connectors, including several SMA types. In other words, they look like something you might not want to pick up unless you are into scrap aluminum. Looking at the designations on the connectors can help you determine what might reside inside, if it is labeled. Most I have found were not labeled with anything I could understand, just cable hookup designators for a specific piece of equipment.

Details to look for are amplifier video output, switched IF in, linear or, even better, log out. These are some of the key words used. Photo C shows an amplifier stating 0.75 to 18 GHz and connectors labeled log, lin, RF in, and power. It does not go to 18 GHz as stated, but was part of a radar receiver assembly that did go to 18 GHz. This amp is strictly low frequency RF, 60 MHz and lots of gain (90 dB).

If you are confused or not sure about an amplifier you might locate, take the cover off to see what is inside. (That's why you should take a small tool kit to a swap meet). Sometimes it can be discrete circuitry and not of importance except for parts. However, if you don't look, your chances of finding a log amp in surplus are slim to none.

There are many different manufacturers who produce these devices in ranges that cover frequencies from a few MHz to about 1 GHz or so. Commercially, they cost upwards of $1,000 each. This cost is indicative of miniature

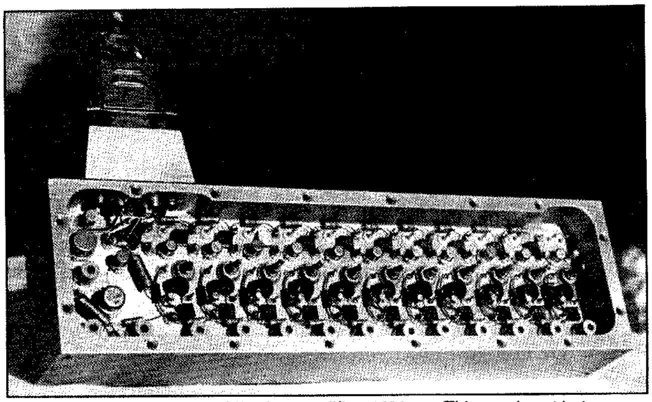

Photo A. Old discrete 60 MHz log amplifier, 12" long. This one has 11 stages.

monolithic substrate type of construction, with assembly under a microscope necessary. Accordingly, they are very small; several can fit into a cigarette flip-top box. Photo B is typical of this type amp. Commercial cost for this baby is $1,700. How many do you want?

I always keep my eyes open at our local electronics swap meet. Some time ago I ran into a dealer having a box of seven or eight modules that looked quite nondescript on the outside. They were inexpensive (less than $10 each), so I looked under the cover. Bingo! I found not just an amplifier, but a log amplifier and several SMA .141 solid coaxial cables.

What to Look For

Now you say, "What is a log amplifier?" Well, it's not a preamp, but it is quite remarkable. It is an instrument amplifier that has a bandwidth centered about a design center frequency, say 60 MHz. The log amp has multi-stages that are all cumulative, summed in a diode network to form a video output of the total amplifier string. The issue isn't the gain of this type amplifier; rather, it is the dynamic range which relates to input sensitivity (in dB) that will still meet output linearity requirements. In other words, we want minimum sensitivity that still can produce a true reproduction at its output and keep the output relationship different for strong signals in the presence of weak signals. Quite an amplifier.

Uses for a log amp can range from IF amplifiers for spectrum analyzer applications to electronic countermeasures receivers for military applications. It's the ability of this log amp to be able to qualitatively analyze low-level signals in the presence of high power signals that makes it special. In this application it keeps the output representation of these signals in their original condition, (linear). The output is presented as a video signal that varies between 0 and 2 volts; 2 volts represents the maximum signal received.

A typical log amp has eight or so stages of gain, with an impedance matching preamp and frequency filter in the first stage. This first stage sets the frequency bandwidth and VSWR of the unit. The next seven or eight stages comprise the main IF amplifier. The summing diode/limiters are all in common with a video output op amp for video information output signals.

Building a Spectrum Analyzer

Putting these devices to work in constructing a spectrum analyzer is quite easy compared to constructing one by hand. The components needed to accomplish this are: an oscilloscope for display; a voltage-controlled oscillator (VCO); sweep control circuits to produce a DC ramped sweep voltage to drive the VCO; and a bandpass filter and log amplifier (see Figure 3). The

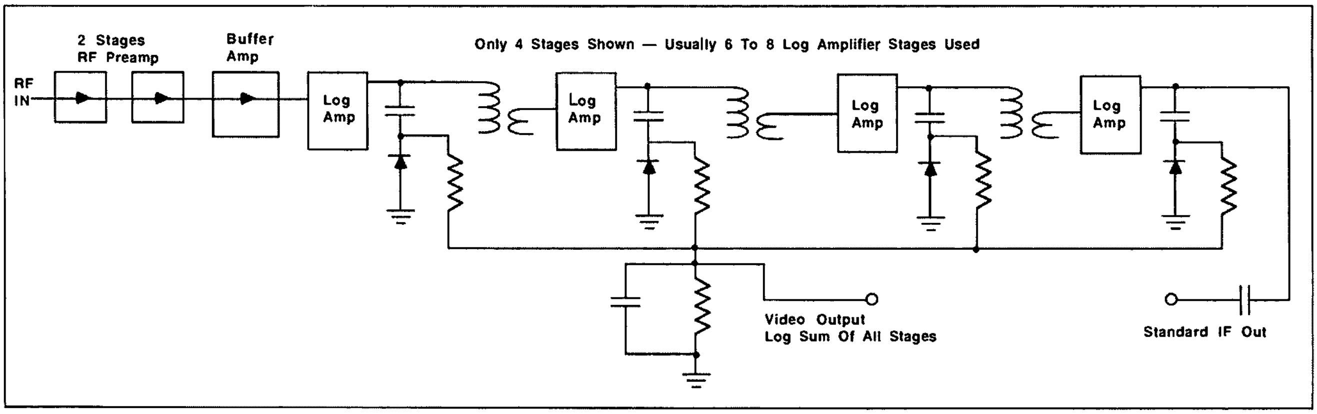

Figure 1. Block diagram of a typical log amplifier. The input preamp is usually followed by a buffer amp stage. Other stages cascade in normal RF fashon, but note the diode coupling network. It is a summing network for video information output. Each stage adds voltage to sum total of output voltages in logarithmic order. This can be used as a standard IF amp if the connection to the last amp stage has output from LC tank circuit.

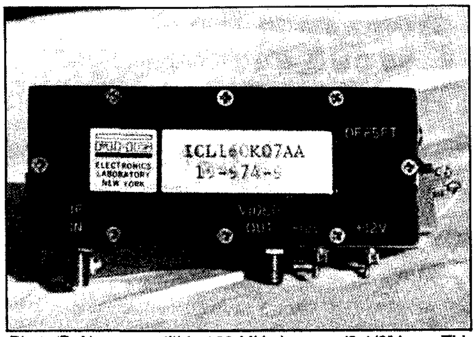

Photo B. New monolithic 160 MHz log amp 2-1/2" long. This one has 90 dB gain with 60 MHz dynamic range.

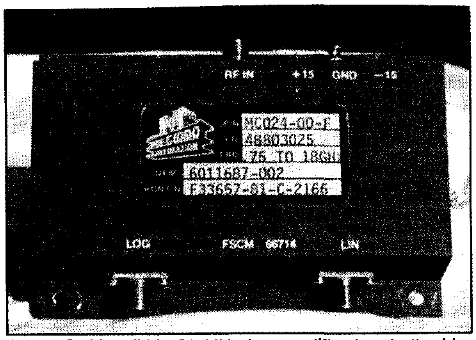

Photo C. Monolithic 60 MHz log amplifier has both video and linear (normal) IF output. Gain is 85 dB at IF, -90 dB for logarithmic (linear) applications.

main consideration for bench use or mobile use is dictated by the o-scope requirements. If you have a small pocket o-scope, the unit will be, needless to say, a versatile base or mobile. If you have to drag an AC plug for the scope, a very long extension cord may be required.

An alternative for the o-scope in surplus would be a medical heart-rate o-scope display unit. These are the units you see on many different emergency-type TV shows that show a scope representation of your heart rate on the screen. Sometimes you hear them "beeping" along with the heart rate. A straight line on one of these babies is bad news, to say the least. For our spectrum analyzer application, they are ideal. They have long persistence not available on normal o-scopes, allowing the trace to remain intensified on the scope screen, with slow sweep cycles.

Being very solid-state and rather new, most operate from AC-derived +12 volts DC power (what a break for us—+12 volts, an easy modification). Also, they are already set up with an internal sweep providing a DC ramp which can be brought out for our VCO; thus we don't need to construct that part of the circuit. Connect an RF preamp and mixer with the VCO and a medical scope and of course our log amp and you have a spectrum analyzer. True, it's not an HP unit, but it does work.

I am not going to go into the mixer or RF circuit here except to say that a suitable unit could be constructed from a TV solid-state tuner. This module covers both the VHF and UHF TV frequencies, and has a built-in oscillator mixer and VCO oscillator IF amplifier. The *normal IF output is quite broad and can* be anything from 30 to about 90 MHz in most units, which is ideal for this application. Couple an IF filter and the log amp with a suitable display and you have a spectrum analyzer that can be used from about 50 to 800 MHz. This of course has some frequency gaps due to the standard TV frequency assignments, but it does give very good coverage.

I wish I had this approach available to me years ago. Back then I saw an article in the August 1982 issue of *73*, titled "Poor Man's Spectrum Analyzer." This article gave full construction details on assembly, including details on construction of a log amp. I not only built the unit but designed PC boards for the project and built the entire unit. It worked fine, covering 10 MHz to over 250 MHz. This was my first spectrum analyzer, of many that were to follow. The log amp in that case was constructed out of 40673 dual-gate MOSFETs for each stage in the log amp. The IF transformers were hand-wound toroids from Amidon and resonated at 60 MHz. Did it work? You bet, but the log amp was about 10 inches long and about two inches wide. Not too bad for home construction. I still have this amplifier around, along with many other early projects, to remind me of my humble beginnings.

Now, if construction of that log amp back then doesn't sound too humbling, maybe I should tell you that the first PC board I ever built used house paint as a resist, applied with a small artist's paint brush. Crude but it worked. I guess I am trying to make my point the hard way. It all boils down to this: You do not need to have a computer to do your design as it can be done with pencil and paper. All the computer does is do the same job faster. If the original thought is not put into proper perspective, there is no fast computer that can help.

Back to the home-built log amp using 40673 FETs. Initially I saw the original article as an interesting project, but without PC boards it would be too difficult to construct. After some time it was determined that I would construct PC boards in order to complete this project. I laid out the component parts on paper using a set of drawing aids that mirror component part sizes either in 1:1 size or two times scale for drawing ease. After laying all component parts on the paper from the schematic, it was just a matter of connecting all the dots from each component to make all connections.

Some of the components may have to be moved to make connections but it's kind of easy once you get the hang of parts placement. It's about as difficult as working a familiar crossword puzzle and many times the fun. Check out Photo D, showing the original spectrum analyzer that I constructed. It works nearly as well as its commercial counterparts. If you can't locate one in surplus (miniature unit) you can build a log amp just as I did. I still have the artwork and silkscreens available and can reproduce the PC boards if there is interest.

By today's standards it's quite large for its function, but it still can hold its own when stacked up to a commercial equivalent. It was made for 90 MHz and has 80 dB of gain and exhibits just over 75 dB of dynamic range. It was constructed over 10 years ago when the alternative available to me was the converted (tube type) IF strips out of WWII radar receivers.

At that time the miniature log amps used commercially were truly UNOBTAINIUM! Most of the test equipment and station apparatus were tube-type equipment. How our lives have changed! Back then my spare tube stock would rival a refrigerator box for space; today my spare tube stock consists mostly of museum pieces.

Whatever type of log amplifier you acquire or build in your application,

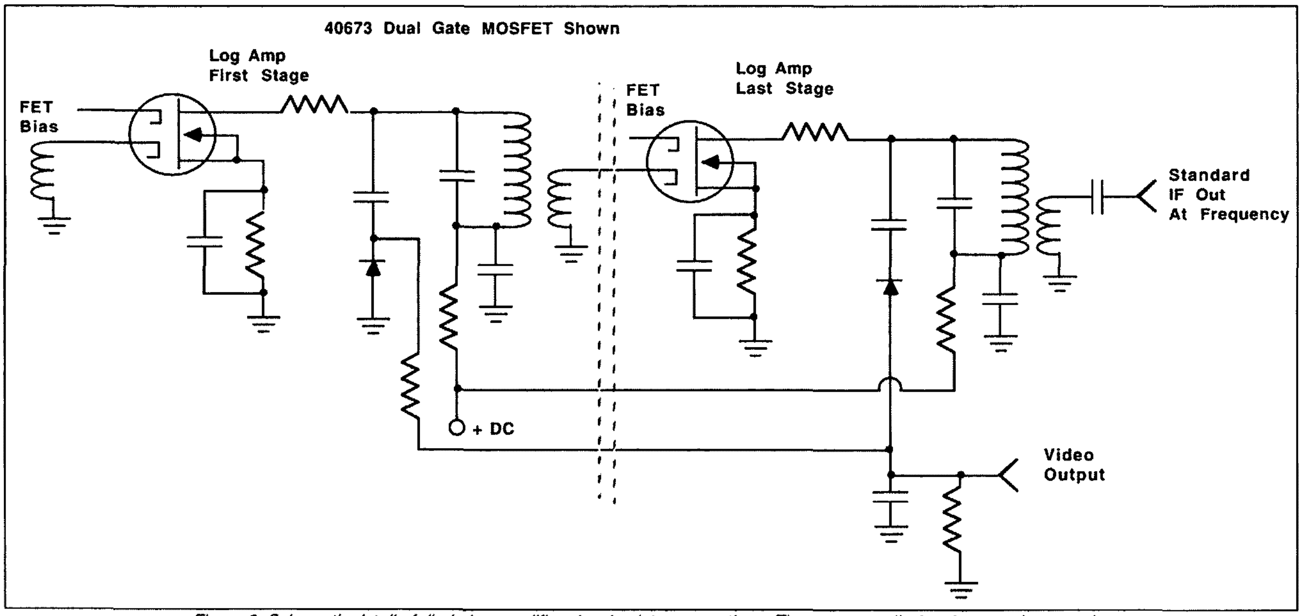

Figure 2. Schematic detail of diode log amplifier showing interconnections. There are usually 6 to 8 stages in cascade.

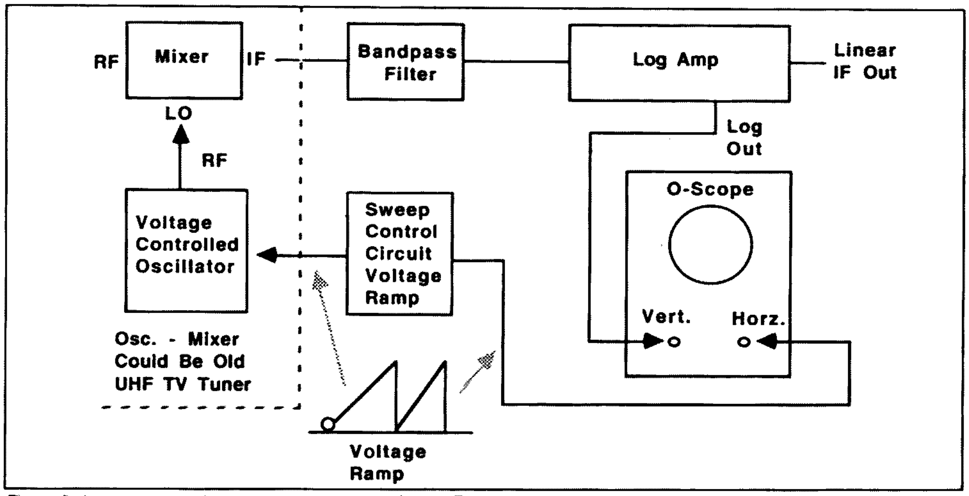

Figure 3. A spectrum analyzer can be constructed from a TV tuner, low frequency oscilloscope, RF filter, log amplifier, and a sweep voltage supply.

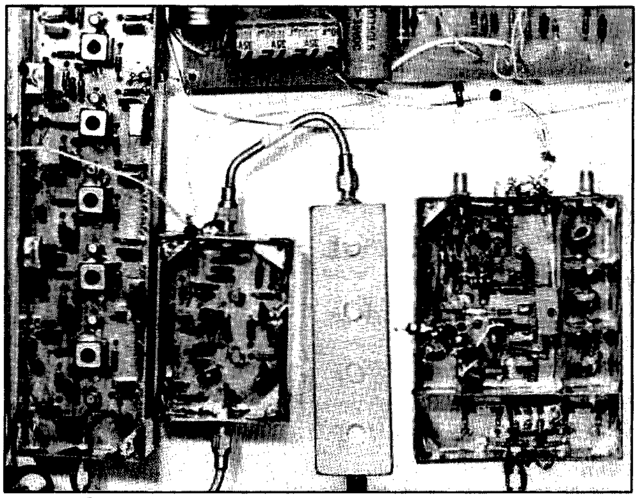

Photo D: Old original home-built spectrum analyzer showing five stages of log amplifier, power sweep circuits, RF preamp and filter, and VCO mixer circuitry.

you will appreciate its dynamic range, abilities, and usefulness in spectrum analyzer applications. I mentioned earlier that with a log amp, a filter, and an RF amp/local oscillator you can make a small unit that is capable of displaying data on almost any type of o-scope. However, as I stated earlier, a long-persistence type unit would be best, similar to a heart-rate display monitor.

The basic system for a spectrum analyzer can be easy to set up. Using a TV tuner front-end removes the construction of both the tracking RF amplifier and oscillator requirements. Now only the filter and log amplifier units are required if you can find a medical heart rate monitor (it has the sweep circuits). Hope you have good luck checking out your local swap meets and surplus material sources for equipment.

Mailbox Comments

Sean KB8JNE of Hilliard, Ohio, writes that he wants me to mention in the column that there must be quite a few Columbus, Ohio, area amateurs with 10 GHz equipment in their basement or attic. He is interested in seeing if those who have equipment are willing to dust it off and give it a try again. He says most of the folks around there have played with it (10 GHz) at one time or another, but found the band empty in the area and filed the equipment away. If that's the case, get the equipment out and contact Sean KB8JNE, 3700 Westbrook Drive, Hilliard OH 43026. He would like to organize a local microwave enthusiast group in the Columbus area. Drop him a line. Sean, I hope you get a good response to your efforts.

Arthur W1PXL wrote to inquire about an antenna noise bridge for VHF/UHF use and asked about schematic information on the construction of such a unit. Well, there is an antenna noise bridge for 1.8 through 30 MHz in the *ARRL Handbook*, 1989 edition, pages 25-32. The same circuit appears in the *ARRL Antenna Handbook*, 1988 edition, pages 27-15. A similar circuit appears in the *RSGB Handbook*, 4th edition, 1983, pages 11.19-11.20. This unit covers low frequency to 200 MHz and will give good results to 432 MHz. The books from the RSGB, Radio Society of Great Britain, are quite good and describe almost all circuits in great clarity of construction. Most seem to be based on a heavy involvement in home construction. They're good books to have on the bookshelf.

Carl AA4H writes that he recently purchased a multimode VHF transceiver. He found many stations to work on 6 and 2 meters and a fair amount of activity on 70 cm; however the activity level on 222 is very disappointing. He reports making only a few QSOs on 222 MHz and most were in the UHF contest except for a few locals. Why is there such a lack of 222 MHz activity? Is it because of the recent loss of the bottom 2 MHz? Carl wants others to use this band as he feels we will lose further parts of the band if we do not increase our activity in this area. For further information, contact Carl AA4H at 5971 Hwy. 126, Blountville TN 37617.

Well, that's it for this month. Next month I plan to start a construction project modifying an SSB transceiver for microwave use. First I will present a basic 28 MHz platform constructed dead-bug style, showing a simple system. Later we will cover a converter to 2 meters using two of the Hamtronics modules to wrap up the 28 MHz to 2 meter SSB transverter. See you next month. As always, I will be glad to answer questions on this or related topics. Please send an SASE for prompt response—family, contest and workbench time permitting. 73 Chuck WB6IGP.

Number 19 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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Ground Loops and Other Bugaboos

Not long ago, I was on my local packet radio BBS and I noticed a bulletin requesting information about ground loops. I answered it, and it occurred to me that I ought to discuss the topic here in the column, since it can be a source of hard-to-find problems in your station. So, let's take a look at ground loops and other things related to ground problems.

Around and Around

What the heck *is* a ground loop anyway? Isn't everything that's connected to ground "grounded"? It seems reasonable to think so, but it just ain't so. In a perfect universe, it would be, but we live here on Earth, and on this planet, and every other place we know of, no material is perfect. In particular, every conductor has some resistance, and any long piece of wire will have some inductance, too. But what is "long"?

It's All Relative

That depends on the frequency you're trying to pass through it! Let's say you have a ground wire for a station transmitting on 80 meters. That wire is 15 feet long. Well, 80 meters is about 240 feet, so 15/240 is 0.0625. That's the fraction of a wavelength the ground wire represents. It isn't much. If you imagine an 80-meter-long sine wave drawn over that wire, you can see that the potential difference between what's at the beginning and what's at the end will be quite small. Consequently, your 15-foot wire is a good ground connection at that frequency. Now let's say you switch to the 10 meter band. Hmmm, 10 meters is about 30 feet, and 15/30 is 0.5, and . . . uh oh, sounds like a problem! Yup, your ground wire is a half wavelength long. So what? Well, draw a 30-foot sine wave over it. As you can see, the voltage potential between the ends is tremendous. So how, exactly, does that "ground" your equipment when the ground point's voltage won't be anywhere near the voltage on the radio's chassis at any given moment?

"What the heck is a ground loop anyway? Isn't everything that's connected to ground 'grounded'?"

The answer is, it doesn't. At 10 meters, this ground wire will actually make things worse by resonating and building up voltage; it's a tuned circuit. You're gonna have one hot rig, and RF feedback into your microphone circuitry is pretty likely. But what's this got to do with ground loops?

A Smaller Scale

The basic idea is the same. Let's say you have several pieces of gear connected together, all with nice, shielded cable. After you connect lots of stuff, the cable length all the way around from the first box to the last can add up. If it happens to hit a 1/8 wavelength, 1/4 wavelength or 1/2 wavelength, watch out when you transmit, 'cause here comes trouble.

The same thing can happen right on a radio's chassis, especially when the frequency of operation goes way up. At microwaves, even a 1-inch spacing between where two "ground" points are soldered can be a very significant part of a wavelength, or even several wavelengths, resulting in their being at different voltage potentials, and thus ungrounded! That's one reason microwave gear is harder to build; you can't even take anything as simple as ground for granted! That kind of problem can occur even in VHF and UHF radios, but it usually doesn't in HF rigs because the wavelengths are so much larger. Still, I've seen some squirrely 10 meter setups; now and then it happens.

Passive Aggressive

But what about receive problems? Ground loops can get you into all kinds of problems even when you're not putting out any energy; ask any recording studio engineer. How? Consider this: There is no such thing as true ground, unless you mean the earth we walk on. Each piece of equipment has a common point it calls ground, but what does that mean in relation to other equipment? Not much. If they're all using the same power supply or at least have their common "grounds" connected to each other, they all should have these common points at the same voltage potential. In theory, at least. In the real world, the length of the cable between the power supply and the rig induces some resistance and inductance, so the radio's chassis may be at an ever-so-slightly-different voltage than the power supply's common point. For most circuits, the millivolts of difference are meaningless, but for low-level amplifiers like microphone input stages, they can be as big as the signal you're trying to amplify in the first place! If current flows from one piece of gear to another, via the ground connection or, more likely, the shield of a shielded cable, you've got a bona fide ground loop, even though you're not transmitting a thing. The usual symptom is AC hum, because it gets induced into the ground wire or shield causing the problem, and it isn't properly grounded out.

In some cases, it can result in RF feedback. That's why most newer HF rigs use a separate ground wire in their microphone jacks. Even though the schematic shows the wires both going to ground, the mike's wire goes directly to ground *at the mike amp*, while the other one goes somewhere else on the chassis. I experimented with that once on my TS-940. With the mike's ground wire connected to the correct point, all was fine. But, if I used the chassis ground wire, I got terrible RF feedback whenever I keyed up. Actually, I found it out by accident once when the two wires touched inside a little mike switchbox I'd built. Oh well, no harm done, but it proved the point: Those two wires, both grounded, were not at exactly the same voltage potential, or there wouldn't have been any difference between them. And that was between two grounds in the same radio!

In audio studios, they sometimes disconnect the braid at one end in order to break the loop. Because the braid is still connected at the other end, it still shields the inner conductor from stray noise, so it works. With RF, though, you can be asking for trouble with that approach, because it can let in enough transmitter energy to cause problems. Remember, we're talking millivolts here.

A Way Out?

Is there another way out of ground loop troubles? Well, with an RF resonance problem, you need to do two

things: get your cable lengths away from any multiple of 1/8 wavelength (usually, avoiding multiples of 1/4 wavelength will do), and keep your antenna as far as you can from the gear, to reduce the amount of signal you pick up in the first place. Also, be sure to connect all the radios' ground terminals to the same point, and then send that on its way to ground. Because of the way it looks, that's called a "star ground." In particular, avoid running your ground braid from radio to radio, with only the last one going to ground; that kind of configuration actually tries to force a ground loop to occur.

With hum problems caused by a passive ground loop, the hard part is figuring out which item is making the trouble. The only way is to disconnect the audio cables one by one. When you hit the culprit, the problem will go away. The cheapest, easiest fix is to disconnect one side of the braid. Try that and, if it works and doesn't cause RF feedback problems when you transmit, you're in business. If it does feed back, though, consider putting a small transformer between the offending items. That makes the ground potentials, at least at the input points which are causing the trouble, irrelevant, because the incoming energy is "floating" with respect to ground anyway! For low level signals, it's pretty easy to do. For microphone cables and such, you can use two small audio transformers back-to-back. In other words, connect the high-impedance sides to your gear, and connect the low-impedance sides to each other. Just be sure to shield the transformers in a metal box, or they may pick up all kinds of RF.

I remember one problem I had with a computer connection to a shortwave receiver. The idea was to pick up weather facsimile transmissions and decode them with the computer, using a simple homemade interface and some nifty decoding software. It worked, but the computer's RF noise made a terrible mess in the receiver whenever it was connected. If I broke the connection, the noise went away, even though the computer was only a few feet away from the receiver. What was going on here?

Well, it wasn't actually a ground loop. I know because I tried running the shortwave on batteries, and the problem didn't go away. Remember, you can only have a ground loop if there's some attempt at a common ground; a floating device can't exhibit the problem. In this case, computer noise was being induced into the ground braid of the connecting cable. So, I tried the transformer approach. That should have done it, but it didn't. Apparently, the noise was strong enough that a little bit of it was still being induced, either through the transformer or through the air, and the garbage was still there. I dreamed of a fiber-optic connection, but I never built it, and I never solved that problem. The interface went into a drawer somewhere. Of course, an outside antenna for the shortwave probably would have cured it, but I didn't have a way to do that where I was living at the time. Oh well, you can't solve 'em all.

Hey, let's look at some letters:

Dear Kaboom,

In the September '93 issue, there was an article discussing compressed antennas. Instead of buying the variable capacitor and coil specified, can I just use my MFJ tuner with this thing?

Signed,
Wanna Make Do

Dear Wanna,

Well, I'm not an antenna maven, but it seems reasonable to try it, as long as the antenna doesn't require its tuner to be right at its base or something. There's a big difference between tuning an antenna at the antenna and way back down the coax line by your rig. But I'd try it. You don't have anything to lose, and you should be able to see on the SWR meter whether your tuner is doing any good. But, even if you get a good SWR, that doesn't mean the antenna necessarily is getting out the way it should. Remember, a dummy load always has the best SWR! In this case, you could see a great SWR at the rig, and the antenna still could be working poorly, especially if you have a long coax run. In any event, give it a try and see what happens. Certainly, if you put the tuner right at the base of the antenna, it should work as long as the project's coil-cap combination is similar in configuration. Unfortunately, I don't have that article handy, so I can't say for sure.

Dear Kaboom,

My old HT-144 walkie has a bad IC. It's the second time it's gone bad, and, unfortunately, it's a proprietary product. I really want to save the rig. Is there anything I can substitute for it?

Signed,
Twice Fried

Dear Twice,

The IC you indicate is the audio power amplifier. If you haven't been playing the rig real loud for long periods, you should wonder why it keeps blowing! The speaker coupling cap, C35, could be leaky. In any event, I have no idea where you can find that 6-pin chip, part number MFC 6070. You can, however, use an LM-380 or even an LM-386, which you can get at Radio Shack for $1.19. Since the LM-series chips are 8-pin devices, the pins won't match up, but you should be able to figure out what goes where by looking at the schematics. Those single-chip mini audio amps are all fairly similar. Gather up your ham spirit and go to it!

Until next time, 73 de KB1UM.

Number 20 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

Well, we made it through Christmas and the New Year celebration without any trouble. But a bug has cropped up in my computer. It seems to have a mind of it's own at times, freezing for no reason, rebooting, etc. Luckily, it only froze up once while writing this column, so I didn't have to retype much (good reason to save quite often). But, I won't press my luck any further this month. Much more next month from Israel, Monaco, South Korea, and who knows where else.

73 for now. Arnie N1BAC

Roundup

Brazil Iwan Thomas Halasz PY2AH is author of the world's first *Radio Amateur's Handbook* in Portuguese. The handbook is published by Edusp (the editorial branch of the University of Sao Paulo) and is destined for the five Portuguese-speaking and also the 18 Spanish-speaking countries. *Handbook do Radioamador* is endorsed by both REP (National Amateur Radio League of Portugal) and LABRE (National Radio League of Brazil). With 633 pages, it is half the size of the present *ARRL Handbook* but almost three times that of the first (1926) edition of the *Radio Amateur's Handbook*, written by Francis Edward Handy W1BDI, to whom the author renders homage in his preface.

Since none of the Portuguese-speaking leagues have editorial facilities and amateur radio literature in Portuguese has been very scarce over seven decades, the new *Handbook* had to fill in the lack of information for amateurs who do not read foreign languages (more than 95% of them), providing them with a worldwide horizon to see their activities in proper perspective. It is expected that the presence of a *Handbook* in most of the shacks in Portugal, Brazil, Angola, Mozambique, and Cape Verde will give amateur radio new thrust and interest in these countries.

The *Handbook* is not only a convenient way for the public to get acquainted with amateur radio and decide about the possibility of becoming a ham, but also the only means to get a comprehensive view of amateur radio as the mass media only refer to it when it becomes news.

Author Iwan Halasz, a broadcast transmitter industry executive and a ham for 20 years, has published more than 130 articles on amateur radio in Brazilian technical magazines. Presently he is a free-lancer and consultant to the two foremost telecommunication magazines of Latin America: *RMT* (in Portuguese) and *Telepress Latinoamerica* (in English and Spanish). For more information, write to 1662 Cardoso de Almeida, 05013-001 Sao Paulo, Brazil.

Chile *Downloaded on packet from the HR AMSAT News Bulletin 226.03:* The first MICROSAT from Chile, to be named CEsar-1, will be launched in early 1995. This announcement was made by the Radio Club Federation in Santiago. The Radio Club Federation will also provide the ground control station for CE-1 after it is on-orbit.

The satellite will be a MICROSAT class similar to AO-16, LO-19, WO-18, and DOVE. The orbit will be sun-synchronous and the altitude will be about 900 km.

The design will include some scientific experiments which will be constructed by students from three local universities, along with some help from the Chilean Air Force.

The estimated cost of the design and assembly of CE-1 will be about US$1 million. The Radio Club Federation said that CE-1 is designed to help facilitate communications between Chilean radio amateurs and amateurs around the world. *[The AMSAT News Service (ANS) would like to thank LW2DYZ of AMSAT-LU for the bulletin item.]*

Dominican Republic *Letter from Bill Meara N2COR/HI8:* When I first walked into the Dominican Radio Club several months ago, I was struck by the fact that in its outward appearances, the club was very similar to my first radio club (Crystal Radio Club—W2DMC). There were the piles of old *QST* magazines, musty old QSL cards, and piles of old radio gear. It was all very familiar. Aside from the different language being spoken, the membership of the club also reminded me of W2DMC—there was the same mix of old-timers and enthusiastic youngsters along with a "character" or two to liven up the club house! Above all, there was the same friendly spirit, the same willingness to help out a fellow ham that has always been the hallmark of our hobby. While our ham bands every day provide very pleasing evidence of radio's ability to forge international friendships, I think that the face-to-face experience in a radio club can be even more gratifying. Soon after arrival at the club, I found myself sharing experiences with new friends in a foreign country: HI8OMA and I laughed together as we both admitted to waking up our parents after contacting our first ZL! HI8LEZ and HI8RMO and I howled with laughter when we recounted the difficulties of demonstrating ham radio to non-hams (Murphy stalks the DR also!). Ham radio does have the power to bring people together.

Radio Club Dominicano (HI8RCD) has recently gone through a noticeable reinvigoration. In addition to our Tuesday night meetings, the Club sponsors a "Can" (a sort of party/get-together) every Saturday afternoon. Our newsletter is back in print and a new yagi tribander is on the roof of the clubhouse. We have an active, informal club net on 146.5 FM simplex.

The holiday season brought a very successful and enjoyable Christmas party in our now renovated clubhouse. A party is not a party in the Dominican Republic without high-volume merengue music! When your correspondent saw the audio equipment being assembled for the party, he speculated that the gear might allow the club to carry out some audio frequency DX! A good time was had by all, with the more animated club members partaking of the merengue music while the more staid amateurs retired to the back yard for some good conversation.

December also brought a club-sponsored foxhunt competition. Here in the DR a foxhunt is a "Caceria de Pichon" which translates as "Hunt for the Young Pigeon." One Saturday, the streets of Santo Domingo were invaded by earnest radio enthusiasts armed with bizarre multi-element 2 meter yagis! After some struggle, the "pigeons" were all captured and the hunters returned to the radio club for an awards ceremony and an afternoon of good fellowship.

1994 promises to be a good year for ham radio in the Dominican Republic. The club plans to offer a Morse code course and we'll be working with a local school interested in adding ham radio to its set of extracurricular activities. We'll also continue to work with a local Boy Scout group. As always, Radio Club Dominicano will continue to be a happy place where hams from all over are welcome. Best of luck in 1994 to all. 73 from HI8! *[Bill Meara, N2CQR/HI8, Unit 5510, APO AA 34041.]*

Ecuador For those of you who enjoy listening to foreign broadcasts, quite a few of those stations send out program notes and one of those is HCJB, The Voice of the Andes, Quito, Ecuador. If you wish to be put on their mailing list, send your request to HCJB, Casilla 17-17-691, Quito, Ecuador, South America.

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

A recurring thread in past columns was how the Department of Transport and Communications (DoTC) was going to deregulate the Australian regulations, with such things as allowing code-free "Limited" amateurs access to 10m FM, granting packet privileges to Novices, etc. These changes were going to be introduced "Real Soon Now," but for one reason or another (a Federal election and a change of name to "SMA" [Spectrum Management Authority]), they never actually saw the light of day. The latest word was that these changes were going to be introduced in the next session of Parliament (around the time this appears in print), so hopefully this long-outstanding matter will be decided soon; until then it is pointless commenting any further. I was hoping to describe the Australian licensing situation, but there was always the danger it would be obsolete by the time it appeared in prinL

Some things, however, never change. It is worth pointing out that the national body in Australia, the Wireless Institute of Australia (or just WIA), actually consists of several autonomous bodies in each state, and a federal-based office that produces the magazine and provides representation to government, etc. All member services are provided at the state level, and these vary (including membership fees) from state to state. As can be imagined, this can lead to some interesting situations, with disgruntled amateurs blaming the wrong body tor perceived shortcomings, etc. The NSW division can lay claim to being the oldest division of the oldest amateur society in the world (founded in 1910), and in spite of this (or perhaps because of it) it has experienced a few ructions lately. As I write this (late December), certain matters have still not been resolved (such as an Extraordinary General Meeting to debate a "No Confidence" motion in the Committee!), and I hope to have further news in a later column.

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2RWI.SYD.NSW.AUS.OC" and "dave@esi.COM.AU" respectively.

CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EA8
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de Gran Canaria)
Islas Canarias
Espana

(With apologies to Bing Crosby) "Chestnuts roasting on an open fire, (the smell of roasting) dried squid nipping at your nose . . . " Isn't that how the song goes? Well, this is the Canary Islands, after all, and things are a little different. No chestnut blight so we still have chestnuts every year in the fall. And for some unknown reason, the street vendors roast and sell dried squid over their charcoal braziers right alongside the chestnuts and the odor is pretty pungent. But I like dried squid so it's no problem. Another difference being here is that Santa's (Papa Noel) or the Three Wise Men's helpers often wear bikinis.

Speaking of dried squid, it figured in one of those pleasant little events that help so much to make life bearable. As I've said before, most of my English tutoring students are Oriental children, while when my wife taught, her students were Spanish adults. The very same day that one of her students gave her a box of high-quality chocolate candy, one of my students gave me a dried squid as a present. In the culture of each student, the present had about the same meaning, and both were greatly appreciated.

Do you think you know Spanish? Are you ready to confront daily life in Spain on Spanish terms? Well, please pack your sense of humor and plan to use it often, mostly to laugh at yourself. If you studied Spanish, you already know about the subjunctive and some of its pitfalls. In a few years you'll get it mostly sorted out. But I'm talking about the things you thought you already knew and could count on. That's where the torpedoes really come at unexpected angles . . . It was Thanksgiving, and the guests eating with us were some Spanish friends who didn't speak English and two Mormon missionaries from the U.S. who spoke some Spanish, so we spoke Spanish. Things were going fairly well until one of the Americans, translating literally from English, said, "Pasame el vestido de la ensalada, por favor." But in Spanish that didn't come out as "Pass me the salad dressing, please," but instead as "Pass me that clothing that the salad wears, please." An instant of absolute silence followed, then a period of laughter from me and my wife (after we had gone through the reverse translation and realized what had happened), confusion from the Spaniards (who didn't know what was happening), and finally an explanation in Spanish and English for all parties so they all could have a good laugh. And I bet you thought "salad dressing" was pretty safe and tame.

Is the tooth fairy "la hada de los dientes"? Not on your life! In Spain it's "el Ratoncito Perez" and don't you forget it. In fact, yesterday some friends gave our baby a Ratoncito Perez doll that plays several tunes about 50 dB too loud, and I'm thinking about how to cut down the volume, short of smothering it under two or three pillows. The first thing will be to put in a jumper instead of one of its two batteries, and halve the voltage.

Thanksgiving was yesterday, and a couple of nice people left a package of brownies for me outside our door with a nice note. There are fine people everywhere, but sometimes you have to look to find them. 73, Woodson N5KVB/EA8.

HAM HELP

Number 21 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I am in need of the schematic and adjustment instructions, or the dual trace pre-amp, for my surplus scope. Scope type is AN/USM-117C. Pre-amp type is MX 2995 A/ USM117. *Mel Wardean K6QXE, 18193 Fisher Dr., Visalia CA 93292.*

WANTED: Circuit diagram for SEIF DM-2000 DVM. I will pay costs. *Keith Ralph VK4VQ, 10 Thredbo Dr., Worongary 4213 QLD, Australia.*

UPDATES

Number 22 on your Feedback card

Micro IDer

In the January 1994 issue, a very discerning reader spotted an error in Program #1 of the above mentioned article. In the listing on page 26, the 29th line says:

{ 44, "1111110101011101110"},/* , */

The line should be:

{ 44, "1110111010101011101110"},/* , */

The correction will produce a proper Morse code comma.

TNX Keith Rice.

NEVER SAY DIE

Continued from page 4

what's happened to your beans is also happening to your mice. And the book explains about it happening to rabbits, chinchillas, and so on down the food chain.

While you're growing those beans, try some in front of your TV set and see what the radiation from that monster is doing to the things around it—including you and your kids. Even try some in the next room, 15 feet or so away from the set. A bean can tell you more than any but the most sophisticated (and expensive) lab instruments.

You'll read about endless cancers being cured, arthritis, diabetes, and so on. Children in school rooms under fluorescent lights have cavities, attention deficits, hyperactivity, poor classroom behavior, poor grades, and learning disabilities. Within weeks of installing full-spectrum lights these problems begin to disappear. It's almost enough to make you think.

They tested hamsters with identical diets under cool-white and full-spectrum fluorescent lights and found they had 10 times as many cavities under the white lights. Chickens raised under full-spectrum lights are larger, healthier, live twice as long, *lay more eggs*, and their eggs have 25% less cholesterol.

It turns out that sunbathing causes less skin cancer, not more, despite all the phony-baloney you've been seeing lately. Heck, they had me so convinced I haven't had a sunburn in years.

I had a little spare time in San Francisco recently, so I visited Alcatraz—where they kept the most incorrigible prisoners in tiny cells with no direct sunlight. And when they caused trouble they put them in "The Hole," where they had no light at all. Talk about doing things in reverse. This confirmed the validity of my proposal for cutting the cost of prisons to almost zero—one which would encourage the prisoners to be outside in the sun, tending to their gardens, growing their own food. How do you grow a Danish?

Is there a connection between the growing crime rate, street gangs, riots, the increase in divorce, the troubles we're having with children, and even the incivility we see all around us, and what we're doing to ourselves with artificial light and window glass which prevents those critically important light frequencies from reaching us? The research *reported in* this book is very compelling. I think you'll be convinced—maybe even enough to actually want to do something about it.

I guarantee you'll be installing full-spectrum lights in your home and your office after reading this book. And you might just have enough gumption to work to get your local schools to change too. I'm convinced that we could substantially lower our health care costs just by letting more sun reach our eyes and skin. Gumption seems in pathetically short supply these days—I wonder if that's got any connection with light?

When you do your bean-growing and mice or rat experiments, be sure to document your work with pictures. If you can set up a video camera for stop-motion photography you'll have a great record, but plain photos will tell the story. And I am going to be very upset if you don't send me a copy of your results.

Pro-fusion & Con-fusion

Here comes Wayne again with another of his enthusiasms. When 2 meter FM and repeaters came along I tried to get you interested. That eventually developed into cellular radio, with many of the top people in the new industry, oddly enough, being hams who'd gotten involved through their interest in repeaters. Then there was computers, which have turned into a fairly big business. Now I think I'm on to an even bigger new technology.

It all started five years ago when Drs. Stanley Pons and Martin Fleischmann announced that they'd discovered what seemed to be a new and mysterious source of power. They suggested it might be cold fusion. Well, that was enough to upset the fission industry, and to threaten the hot fusion scientists even more. Worse, many of the hasty early researchers were unable to get the promised excess heat from their experiments, so they pooh-poohed the whole thing. And that's probably all you've read about cold fusion . . . unless you read more than I think you do.

I'm just back from the Fourth Cold Fusion Conference on Maui, where I sat getting more and more excited through four days of scientific papers, all demonstrating remarkable successes in generating heat from both heavy and light (regular) water—heat far beyond anything attributable to chemical reactions. One of the presenters was a youngster from Texas who, though he's invested less than $5,000 in the last four years while working in his basement, has been generating significant heat. He hasn't done anything that just about any ham with a pioneering drive couldn't do.

Yes, of course I'm starting a cold fusion magazine to try to help the field grow faster and help newcomers come up to speed. It worked with repeaters, computers and digital audio, so maybe I can do it again.

If you've been doing your homework as I've asked you to, you read the article in the August 1993 *Popular Science* on the subject. You also should get Gene Mallove's book, *Fire From Ice*. Gene, by the way, is the editor of my new magazine. It looks to me as if we're right at the beginning of a new trillion-dollar industry—one that will help end automobile pollution and cut energy prices substantially. It's a little early to sell your oil stocks short, but I sure wouldn't recommend them for an investment. Cold fusion is super bad news for the Middle East. They'd better stop wasting their oil dollars and make some long-term investments.

I'm using the *term* "cold fusion" because that's what they're calling this newly discovered reaction between palladium and heavy water (deuterium). The scientists haven't yet been able to figure out a theory they can agree on for why it works. Some experimenters have been reporting as much as 10,000 times the heat output from their experiments than they've put in to get it started. They're having success not only with palladium, but also with nickel, platinum, rhodium, and rubidium so far.

Though the effect was first discovered by Americans, the Japanese have already taken a big lead in research, and in smothering us out of the field with patents. Though our government doesn't yet believe in it, Japan's MITI has just budgeted another $30 million to help speed their research and patenting positions.

Well, I could write for pages on what's happening in cold fusion—but please remember, I let you in early on this one, just as I did on microcomputers and cellular telephones. In those cases other people made millions (and billions), and you didn't. I didn't do too badly myself, much to my surprise.

If you're interested in knowing more about *all* this you may want to get a charter subscription to *Cold Fusion*. It's $100 a year. Send your check or credit card information to Peterborough NH 03458-1107 or call (603) 924-0058. Who knows, maybe you'll be giving a paper at the next cold fusion conference. I hope so—and I'll be there cheering you on. Or perhaps you'll be manufacturing a thermos-bottle-sized water-powered generator to power cars, trucks and homes.

Other Scientific Frontiers

Did I pique your curiosity or perhaps even your entrepreneurial spirit with my piece on a cure for AIDS in my February editorial? Have you written to me yet? It looks to me as if a few people will jump at this opportunity and (a) make big fortunes, (b) provide a desperately needed service. What's it worth to clean up HIV-infected blood supplies? What's it worth to save the lives of millions of people with AIDS who now believe they are eventually doomed?

Then there's the need for more research in plant and animal bioelectricity and magnetics. There's a need to look into an almost endless number of anomalies. But watch out for the pathological skeptics. I'm skeptical about new things, but that doesn't stop me from being open to finding out more about them.

One of my problems is that I'm busy in every spare minute reading more and more books. I've been traveling a lot recently . . . the Caribbean, Germany, Maui, Indiana, New York, San Francisco, Los Angeles . . . complete with a suitcase full of books in my baggage. When I consider all the things I want to do, I get discouraged when I see people playing golf or kids hanging out in malls or on corners, doing nothing. What a waste!

Now that I've met Pons and Fleischmann personally, I want to talk more with them . . . and with the other key researchers in the field. I want to learn more about fusion, about bioelectromagnetics, about memory, UFOs, psi, and so on.

Politics

I have to admit to being discouraged at the way virtually all Americans are putting up with the baloney that's going on. There *are* perfectly good solutions to all of our major problems. We could have an incredibly great country instead of a good one, but we won't unless someone finds a way to get people interested in changing things. When we refuse to try and do something to solve our problems, then we're condoning them. We've been putting up with major messes, and putting up with them by just sort of quietly complaining, but not doing one damned thing to bring about change.

We know that we've allowed Congress to be a disgusting bunch of crooks. We know the Clintons have just socked us with a huge tax increase and are fighting every proposed budget cut, doling out pork *bribery for acquiescence*. We know our whole country is awash in drugs, that we've got the worst crime problem and the most murders of any developed country in the world (at an estimated cost of $450 billion a year), that our school system is horrendously expensive and pathetically ineffective, that we're up to here in lawsuits, in escalating health care costs ($1 trillion a year), that we're being screwed over by the IRS, FDA, CIA, FBI, FDIC, and a bunch more government agencies, that despite hundreds of billions wasted we still have poverty, street gangs, welfare families, and so on. Not one of these problems is insoluble. I've proposed inexpensive solutions to all of 'em. So we're floundering in Somalia and Bosnia, and wondering what to do in a few dozen other countries where we have no real strategic interest. We're throwing away billions on foreign aid. Phooey. What a bunch of wimps we Americans are! What does it take to actually get us mad enough to do something?

We're watching an endless parade of TV exposé programs showing us where billions of our dollars are being stolen by fraud. But does this get anyone upset enough to do something? No, a few people are busy parading against abortion, acid rain, global warming, and stuff like that. Did you read the lead article in the February *Reader's Digest* yet? How much do you know about Janet Reno and the other Clinton picks? We're up to here in messes and we're wondering what sitcom to watch.

That Loud Noise Again

It's opportunity, still trying desperately to get you out off the couch to

answer the door. In January I suggested an easy way to get into your own small business. All it takes is a digital audio tape (DAT) recorder, a couple good mikes, and some gumption. The recorder and the mikes are the easy part. Unfortunately, our school system has done a fantastic job of making sure that a minimum of gumption emerges from our high-priced socialist unionized brainwashing system.

I suggested you go out and make some recordings of street performers. Well, that's just for starters. No matter how far out in the sticks you live, you've got plenty of recording possibilities. You've got enough potential customers to pay for the cost of a recording system in short order and build a nice little spare-time business . . . so I don't want to get any more letters whining about the high cost of rigs and magazine subscriptions. Get off your butt and take charge of your life.

So what can you record? Well, I was going to suggest to the people with recording studios that they go after the school and church markets, but after thinking it over, I realized that most of them are so wrapped up with recording local rock groups that I'd probably never get them off their duffs. School market? Churches? You bet!

Just about every high school and college has a glee club and a school band. Some have a few student musical groups too . . . even some (ugh!) rock bands. Every one of these musical (or pseudo-musical) groups needs compact discs and cassettes to sell to make money. Find 'em. Sell 'em. Record 'em. The Independent Music Producers Syndicate (IMPS) will take it from there and ship you the CDs and cassettes.

You can sell 'em a thousand CDs for $5 each and they can turn around and sell 'em for $16.95. That's an easy way for them to generate an extra $12,000. That'll go a long way toward new instruments, concert tours, costumes, or whatever. And by the time they've sold 300 CDs the whole works will have been paid for. The rest is gravy! They can probably even presell that many so they won't even need any money up front.

If you get busy right away you may be able to get a bunch of schools to invest in CDs to sell to the graduating class and their families come June. These might feature selections from the glee club, the school band, and any other school musical (or semi-musical) groups or performers. All you need to do is learn how to make some decent DAT recordings and do some selling.

Church choirs are another group that can be recorded. Some churches have boys choirs and would love to have CDs to sell to make money to help pay for summer choir camp. When I was a tad I sang soprano in the St. Paul's Church choir and we had a great time at summer choir camp. Churches are always in need of money for things, and CDs are a great way for them to make money.

A good DAT recorder and a pair of mikes shouldn't cost much over $1,000 these days. If there's much of a demand I'll talk with some of the manufacturers and see if I can make a deal and get some discounts. Who knows, between schools, churches, and other local musical talent, you might find yourself in a full-time business. It beats the heck out of working for someone else.

What's in it for you? Figure around 50¢ a CD as your cut of the deal. That's $500 for every thousand you sell. Hey, if you only make one deal a week that's a couple thou' a month to help beef up your hamshack . . . or to get the XYL a better fur coat. Fix up your hamshack first.

By the way, each of your recordings will be checked out by a Music Research Foundation focus group. If any get high marks from this tough team of experts they could be accepted for national distribution through our network of over 5,000 independent record stores and be promoted to radio station music directors. Then we could be talking big bucks.

Yeah, I know . . . it's too much trouble. Where's the microwave popcorn?

United We Fall

Perot's United We Stand America looked like a good deal . . . for a while. From what I could see in trying to deal with them it suffered from massive mismanagement at the Dallas headquarters, and that helped keep it from growing quickly at first. I don't know about the paid state coordinators in other states, but the chap they picked in New Hampshire never seemed to bother to pick up the ball, or when he did, then he soon dropped it. We got precious little coordination or communications. Then came the Perot NAFTA debacle, and pffft went interest in UWSA up this way.

That was discouraging because it was the only group that looked as if it might gear itself up to try and clean up the mess the administration and Congress are making out of things. We know the Democrats and the Republicans aren't going to change anything much. And the Libertarians, though they have some great ideas, are almost invisible. Now, with the vaporizing of UWSA, what's left?

Wayne In Hawaii

I was able to make a few contacts as I visited all six of the main islands, but precious few. And what few repeaters I found open seldom had anyone listening. I called and called over one repeater after another. Phooey. My best repeater experience was the W6KAG repeater on Molokai. I first talked through it from Lanai, and then met Butch on Molokai, where he drove Sherry and me from one end of the island to the other, including a fantastic view of the old leper colony from high atop a cliff overlooking that corner of the island.

I was out there for the cold fusion conference on Maui, so I left a few days early and got in some scuba diving on Kauai, Oahu, Molokai, Kona, Lanai, and Maui. The water was awfully cold, so I had to borrow wet suits to keep from freezing. I had my underwater video camera along, but outside of a bunch of small fish at Kona and several big turtles at Maui, the pickin's were pretty crummy. It doesn't hold a candle to a bunch of the diving spots in the Caribbean. No sharks. No whales. No manta rays. I did get a fleeting glimpse of some porpoises. I was hoping for better.

Wayne whips up some contacts from Lanai.

The conference was exciting. There I had an opportunity to meet the movers and shakers in the cold fusion world. I'll be writing a lot more about that.

If you're interested in a day-by-day report on the trip, I've put it together into a 24-page booklet, *Uncle Wayne's Hawaiian Adventure.* Send $3 for a copy postpaid. Eventually I'll probably add it to some other stuff I've been writing and have another book. I've finished one on my submarine adventures in WWII (52 pages), another on my diving adventures (96 pages), and one on my recent travels (48 pages). But then you haven't invested in my *We The People Declare War On Our Lousy Government* yet. Tsk. Well, a few hundred of you have bought the book, and I thank you for your wonderful letters.

Ordering Books and CDs

[Editor's Note: Wayne often references books and CDs in his editorials. The books are often available from Uncle Wayne's Bookshelf; the CDs from IMPS by Mail. Both can be ordered by telephoning (800) 234-8458 or (603) 924-4196, or by faxing (603) 924-8613.] 73

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Special Event. Check Special Events File Area #11 on our BBS (603-924-9343). for listings that were too late to get into publication.

MARCH 5

ABSECON, NJ The Shore Points ARC will sponsor its 12th annual hamfest, "Springfest '94," at Holy Spirit H.S., Rte. 9, 1/2-mi. south of Rte 30. Doors open at 9 AM (7 AM for sellers). Talk-In on 146.385/.985. Contact *SPARC, P.O. Box 142, Absecon NJ 08201.*

DENVILLE, NJ The annual North Jersey Hamfest, sponsored by Split Rock/West Morris, will be held on Morris Ave. starting at 8 AM (sellers 6 AM). VE Exams at 9 AM sharp. Sign up by 9 AM. Talk-in on 146.985 and 223.86. Contact *Bernie WB2YOK, P.O. Box 251, Flanders NJ 07836; (201) 584-4423.*

LANCASTER, NH Twin Mountain NH Town Hall (near the intersections of U.S. Routes 3 and 302), will be the location of a Hamfest and Fleamarket to benefit D.A.R.E. The North Country ARC and Littleton ARK will co-host this event from 8 AM-3 PM EST. Talk-in on 146.55 MHz simplex. Contact *Richard C. Force WB1ASL, 12 Cottage St., Lancaster NH 03584. Tel. (603) 788-2202*

TUSCALOOSA, AL The Black Warrior Swapfest will be held from 8 AM-4 PM at Northport Civic Center, Hwy 82 at Hwy 43, Northport AL. VE Exams at 8:30 AM; contact *David Drummond WB4HHY, (205) 339-7915.* Indoor Swap Area. For details contact *Kelly Bruce WD4DAT, (205) 339-7882 after 6 PM.* Vendor/Table info: *Danny Buford KC4RLR, P.O. Box 032171, Tuscaloosa AL 35403; (205) 339-5812. after 6 PM.* Talk-in on 147.300, 146.820, 147.060+, 145.350-, or 444.700+.

MARCH 6

NORTHAMPTON, MA The Smith Voc. School on Rte. 9 has been choosen as the site for the 10th Annual MTARA Amateur Radio Flea Market. This event will be presented by the Mt. Tom Amateur Repeater Assn. Inc., starting at 9 AM (8 AM for vendors). ARRL VE Exams at 10 AM. Vendor Reservation Contact: *Jim K1MEA, (413) 527-3199 eves. before 2200 EST.* VE Exam Registration: *Jim WA1ZUH, (413) 245-3228; or @ MTMBBS via packet.* Advanced registration strongly recommended.

MARCH 11

ST. LOUIS, MI The Jefferson Barracks ARC will hold their 34th annual RADIO AUCTION at Concordia Turner's Hall, 6432 Gravois, in south St. Louis City. Doors open at 5 PM; the auction starts at 7:30 PM. Talk-in on 146.34/.94, 144.61/145.21. Contact *Vivian WD0EMS, or Scotty KA0FJA, 4121 Fabian Dr., St. Louis MO 63215. Tel. (314) 631-4068.*

MARCH 12

COLBY, KS The Trojan ARC's 1st annual Swapfest will be held from 9AM-5 PM CST at the Colby Nat'l. Guard Armory on K-25. VE Exams March 11th at 6:30 PM at Sirioln Stockade. Early-bird dinner. More. Contact *TARC, Box DX, Colby KS 67701.*

MARCH 13

BRISTOL, CT The Insurance City Repeater Club will hold its annual Hamfest and Computer Flea Market from 9 AM-1 PM at Bristol Eastern H.S., King St. (RT 229). Talk-in on 146.88 and 224.80. VE Exams by pre-registration only. Write *ICRC, P.O. Box 165, Pleasant Valley CT 06063.* SASE required. Flea Market contact: *Chuck Motes K1DFS, 22 Woodside Ln., Plainville CT 06062. Tel. (203) 747-6377.*

INDIANAPOLIS, IN The Indiana Hamfest/Computer Show will be held by the Morgan County Repeater Assn., starting at 8 AM, at Indiana State Fairground's Pavilion Bldg. Advance reservations recommended. Talk-in on 145.25. Contact *Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47403. Tel. (812) 339-4446.*

YORK, PA The 7th annual York Springfest (Ham & Computer) will be held at the York Fairgrounds. Doors open at 8 AM. ARRL VE Exams 8 AM. Talk-in on 146.97-, 447.275- and 53.97-. Write with SASE to *York Springfest, P.O. Box 526, Red Lion PA 17356*; or call *(717) 843-7864* to leave a FAX or message.

MARCH 14-17

TORONTO, CANADA The Internat'l Symposium on Digital Audio Broadcasting (DAB) "The Sound of 2000" will take place at the Sheraton Centre Hotel and Towers. Contact *DAB Symposium '94, 126 York St., #401, Ottawa, Ontario Canada K1N 5T5. Tel.: (613) 241-9333; FAX: (613) 565-2173.*

MARCH 15-17

VISALIA, CA The 1994 Internat'l DX Convention will be presented at Holiday Inn-Plaza Park by the Southern California DX Club. Pre-registration deadline March 15. For info contact *Don Bostrom N6IC, (818) 784-2590 or (310) 334-8717.* For lodging: *Holiday Inn, (209) 651-5000; The Raddison Hotel, (209) 636-1111; the Lamplighter Hotel, (209) 732-4511.*

MARCH 19

MOREHEAD CITY, NC VE Exams will be administered by the Carteret County ARS at First Presbyterian Church Fellowship Hall, 17th & Arendell St. Please pre-register. Contact *Art Sylvester KC4QD, 613 North Forty Rd., Moorehead City NC 28557-3075.*

WEST ORANGE, NJ A Hamfest will be held by the Irvington-Roseland AC, from 8 AM-2 PM at West Orange H.S., 600 Pleasant Valley Way. Talk-in on W2QR Rptr., 147.415/146.415; 146.520 simplex. Contact *Howie Greenwald W2VHI, (201) 994-4057,* or *Jim Howe N2TDI, (201) 402-6066.*

MARCH 19-20

FORT WALTON BEACH, FL The Playground ARC will hold their 24th annual Ham/Swapfest at the Ft. Walton Beach Fair Grounds from 8 AM-5 PM Sat., and 8 AM-3 PM on Sun. For RV space, call *Stan WD4PEU, (904) 243-8801.* To pre-register for tables, call *Bud K8YNU, (904) 243-5404, 3 PM-6 PM CDT;* or *Jerry N4ZYB, (904) 862-0419, 6 PM-9 PM CDT.* For info regarding commercial space, meetings, or forums, write to *P.A.R.C., P.O. Box 873, Ft. Walton Bch FL 32549.*

MIDLAND, TX Midland ARC will hold their annual St. Patrick's Day Swapfest at the Midland County Exhibit Bldg., Sat. from 9 AM-5 PM, and Sun. from 8 AM-2:30 PM. VE Exams at 12 PM on Sat. Contact *AA5RS* or *N5TQU* via *M.A.R.C., P.O. Box 4401, Midland TX 79704.*

MARCH 20

LEXINGTON, MA The Minuteman Repeater Assn. will hold their MMRA Flea Market at the Westboro MA H.S., beginning at 10 AM (set-up at 8 AM). Talk-in on 146.61, 146.82, 449.925 and 223.94. Send table requests and pre-payment to *MMRA, P.O. Box 2282, Lexington MA 02173.* A walk-in VE session is available. For info, call A. Morrison N1BHI, (508) 489-2282.

MILTON FREEWATER, OR The 48th annual W7DP Swapfest, sponsored by the Walla Walla Valley ARC, will be held from 8 AM-3:30 PM at the Milton Freewaler Community Center bldg. Talk-In on 147.280. Contact *David L. Pence KB7WRT, 810 E. Sumach St., Walla Walla WA 99362-1348. Tel. (509) 525-2529.*

MONROEVILLE, PA The Two Rivers ARC will hold its 22nd Hamfest/Computer Show at the Pittsburgh Expomart on Business Route 22, from 8 AM-3 PM. Talk-in on 146.73. Check-in (good for a prize) on 146.52. For reservations and info, send SASE to *Two Rivers ARC, P.O. Box 225, Greenock PA 15047-0225.*

STERLING, IL The Sterling-Rock Falls ARS 34th annual Hamfest will be held at the Sterling High School Field House, 1608 4th Ave. Talk-in on 146.25/146.85 W9MEP Rptr. Contact *Lloyd Sherman KB9APW, P.O. Box 521, Sterling IL 61081. Tel. (815) 336-2434.*

YONKERS, NY The Westchester Emergency Comm. Assn., Inc. will hold "WECAFEST 1994" at Yonkers Raceway, (Intersection of I-87, Central & Yonkers Ave.) from 9 AM-2 PM. Talk-in on 147.06/.66. Contact *Jeanne Raffaelli, (914) 962-9666.*

MARCH 26

ELIZABETHTOWN, KY The Lincoln Trail ARC has chosen the Pritchard Community Center as the location for their indoor Hamfest. This event will be open from 8 AM-4 PM (set-up Fri. 7 PM-9 PM). Talk-in on 146.98. Contact *Whitey Hensley, P.O. Box 342, Vine Grove KY 40175. Tel. (502) 877-2234.*

MICHIGAN CITY, IN Visit Rogers H.S., Pahs Rd. between Woodland Ave. and Johnson Rd., to enjoy a Hamfest being presented by the Michigan City ARC, between 8 AM-2 PM (Set-up 6:30 AM). Talk-in: 146.49 simplex or 146.37/.97 Rptr. (131.8 Hz PL). VE Exams. Contact *Gene Ward KD9VB, 312 Ash Pkwy., Westville IN 46391. Tel. (219) 785-4295.*

UPPER SADDLE RIVER, NJ The Chestnut Ridge Radio Club will sponsor its annual Flea Market from 8:30 AM-2 PM, at the Education Bldg., Saddle River Reformed Church, East Saddle River Rd., corner Weiss Rd. Talk-in on 246.955 Rptr. Contact *Chestnut Ridge Radio Club Inc., Box 110, Teaneck NJ 07666.*

MARCH 27

MADISON, OH The 16th annual Lake County ARA Hamfest will be held at the Madison H.S., Intersection of Middle Ridge and Burns Rds. Doors open from 8 AM-3 PM. Flea Market. VE Exams. DXCC Field Card Checking, and more. Talk-in on 147.21 and 224.50. Contact *Roxanne, LCARA, 6899 Meldridge, Concord OH 44060. Tel. (216) 352-6756 (6 AM-9 PM EDT weekdays; 10 AM-4 PM weekends).*

APRIL 2

COLUMBUS, IN The Columbus ARC will host a Hamfest at Bartholomew County 4-H Fair Grounds, Family Arts Bldg., on State Rd. 11, from 8 AM-2 PM. Talk-in on 146.790/146.190. Make reservations thru *Marion Winterberg WD9HTN, 11941 W. Sawmill Rd., Columbus IN 47201. Tel. (812) 342-4670.*

LONGMONT, CO The Longmont ARC will hold its annual LARCFEST from 8 AM-3 PM at the Boulder County Fairgrounds, Hover and Nelson Rds. VE Exams at 1 PM. Talk-in on 147.27/.87 or 146.52. Contact *Randy Stevens N0NMD, 5280 Cypress Dr., Boulder CO 80303. Tel. (303) 499-1106.*

SPECIAL EVENT STATIONS

MARCH 12

TITUSVILLE, FL The Titusville ARC will operate 1400Z-2300Z to commemorate the 150th Anniversary of Brevard County, and the 3rd Anniversary of the Mosquito Net. Frequencies: CW—near the bottom of the Novice 10, 15, and 40 subbands; phone-28.333 (Mosquito Net freq.) and near the bottom of the General 15 and 40 subbands. For a certificate, send QSL and a 9x12 SASE to *TARC, P.O. Box 73, Titusville FL 32781.*

MARCH 12-13

DAYTON, OH The Farout ARC presents "The Last Blast of Green," a Special Event Station operating from St. Patrick (Shelby County) OH during the period 1800Z 12 Mar.-1800Z 13 Mar. Operation will be from the final St. Patrick's Church Parish Festival; the church is scheduled to close its doors July 1st. Frequencies: Lower portions of: 80, 40, 15, 10m Novice CW; 20m General CW; 80, 40, 20, 15m General phone; 10m Novice phone (as band conditions dictate). The Farout ARC QSL's 100% to amateurs and SWL's; via the bureau, or a business-size SASE to: *WB8SMC,*

Farout ARC, P.O. Box 9181, Dayton OH 4509-9181.

EUGENE, OR The Quarter Century Wireless Assn. will hold their QCWA phone QSO Party from 0000 UTC-24000 UTC. Operation will start at 30 kHz inside the General phone band. The WARC frequencies will not be used. Regular callsigns will be used for all contacts. Send logs to *Bob Reed WB2DIN, 597 Brewers Bridge Rd., Jackson NJ 08527.* For info contact *Bill Miller, K2GCE Activities Manager, 217 Porterfield Pl., Freeport NY 11520.*

MARCH 13-14

MILWAUKEE, WI The West Allis RAC will sponsor the 1994 Wisconsin QSO Party from 1800Z Mar. 13th-0100Z Mar. 14th, for CW and phone. Mail logs by March 31st. For details, contact *WARAC, P.O. Box 1072, Milwaukee WI 53201.*

MARCH 20

PISCATAWAY, NJ Member stations of the Piscataway ARC will operate their stations, signing /VOA, from 0000Z-2400Z, to commemorate the World War II operation of the Voice of America relay station WBOU, in the Bound Brook section of Piscataway. Frequencies: CW—All Novice bands; Phone—Lower 1/3 of General 75-15m bands, and the Novice 10m band. For a certificate, send QSL and 9x12 SASE to the call book address of the station worked.

MARCH 26

SANDUSKY, OH The Sandusky Radio Experimental League will operate W8LBZ 1500Z-2400Z to celebrate its 60th Anniversary. Operations will be in the General 40, 20, 15 meter bands and on 146.655 and 444.375. For a certificate, send QSL, contact number, and SASE to *Sandusky Radio Experimental League, 2909 W. Perkins Ave., Sandusky OH 44870.*

MARCH 26-27

MACON, GA The Macon ARC will operate W4BKM 1300Z-2000Z on March 26th and 27th at the 12th annual Macon Cherry Blossom Festival. CW: 7.135, 14.035, 21.135, and 28.135. Phone: 7.235, 14.235, 21.335 and 28.335. For a certificate, send QSL and 9x12 SASE to *Macon ARC, P.O. Box 4862, Macon GA 31208.*

APRIL 7

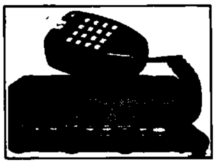
GLENBROOK, N.S.W. In commemoration of the 140th Anniversary of the first morse telegraph circuit in Australia (between Melbourne and Williamstown), the Sydney Morsecodians Fraternity will establish a morse link between Melbourne and Williamstown (with the venues at each end yet to be identified). The Science Centre in Canberra will be linked with both terminals so that messages may be exchanged between the three centers. Visitors will be able to send brief telegrams to relatives or friends, without charge.

Number 25 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

ICOM



Icom has introduced the IC-Delta 100H multiband transceiver, with features never before imagined in a mobile radio. This beauty has a full-control microphone which allows total control of the entire operational menu. In addition, you can electronically mix and match the three bands according to your personal preferences.

The IC-Delta 100H has independent 144, 440, and 1200 MHz band units; each display can be freely selected for the band of your choice. A duplexer or triplexer can be connected without any mismatching antenna loss, using a single antenna connector. Mobile installation is a breeze, especially with the optional OPC-332 or OPC-333 detachable front panel separation kit.

Each band has 100 memory channels, six scan edge channels (three pair for program scan) and one call channel. There are two banks of these channels for divided programming. Therefore, the total number of memory channels available is an amazing 642!

For further information, contact your local Icom dealer, or contact *Icom America, Inc., 2380 116th Ave. NE/P.O. Box C-90029, Bellevue, WA 98009-9029; (206) 454-7619, Telex 152210. FAX (206) 454-1509.* Or circle Reader Service No. 201.

CABLE X-PERTS, INC.

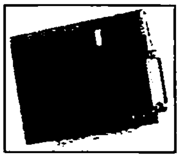
Cable X-perts, Inc. has added two new 50 ohm low-loss cables to its product line—the LMR 400 and the LMR 600. The LMR flexible communications cables use a specially designed solid-copper-clad aluminum center conductor and a unique foam dielectric that is moisture- and crush-resistant.

The LMR 400 has an o.d. of 0.405, which is the same as the 9913, yet it has lower attenuation and a smaller bend radius. This cable uses standard PL259 or N type connectors.

The LMR 600 has an o.d. of 0.560 that is smaller than jacketed 1/2" hardline. This cable has only slightly higher attenuation and is approximately 30% lower in cost per foot.

The velocity of propagation for these new cables is 89% The shielding is a tinned copper braid over 100% bonded aluminum foil, providing a shielding efficiency of 90 dB. The polyethylene jacket is ultraviolet-resistant and suitable for direct burial. For further information contact *Cable X-perts, Inc., 113 McHenry Rd., Suite 240, Buffalo Grove, IL 60089; (800) 828-3340.* Or circle Reader Service No. 202.

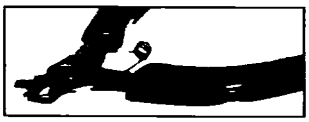
UNIFIED MICROSYSTEMS



Unified Microsystems has introduced the Contest Card, a PC plug-in interface board that contains a voice recorder/keyer and CW interface. This unit allows hams to record their CQs, callsigns, contest exchanges, or other voice messages for transmission under control of their computer.

Primarily designed for contesters and DXers, the Contest Card can also be used with PC-based repeater controllers for ID and special voice messages, VHF meteor scatter transmissions, and for other applications. The board can also directly drive an external speaker for non-radio applications.

The Contest Card is available in kit form for $119.95 or assembled and tested for $179.95. Shipping is $5 for the US and Canada. Cable not included. For further information contact *Unified Microsystems, P.O. Box 133, Slinger, WI 53086; (414) 644-9036.* Or circle Reader Service No. 204.

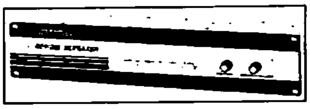


RF INDUSTRIES

RFI has announced the stainless steel Gripper Nipper hand tool Model RFA-4084. This unique wire cutter will hold the cut piece of wire firmly in the cutter until it is released by opening the tool. This feature eliminates a major problem with most cutting pliers: small pieces of wire flying from the tool into equipment where they can cause short circuits.

The RFA-4084 Gripper Nipper is priced at $12 and is available at RFI dealers. For more information contact *RF Industries, LTD, 7620 Miramar Road, San Diego, CA 92126; (800) 233-1728.* Or circle Reader Service No. 207.

HAMTRONICS, INC.



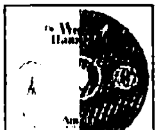
The popular Hamtronics line of VHF and UHF FM Repeaters has just been expanded to include some very interesting new models.

The new REP-200T Repeater has all the features of the standard microprocessor-controlled REP-200 Repeater, with the addition of a new DVR-3 Voice Digital Recorder Module. This allows messages to be recorded off the air remotely. It is no longer necessary to use a microphone attached to the repeater to record messages. DTMF commands control the record and playback modes. Thus, the control operator can change the message at any time and repeater users can request a playback at any time.

With the availability of low-cost digital voice recorders, Hamtronics also has developed an economy repeater with a voice ID built in. The new REP-200C Repeater uses a new COR-6 controller module with voice ID, but no DTMF decoder or autopatch.

Either of these new repeaters can be ordered for 6 meter, 2 meter, 222 MHz, and 440 MHz ham bands. The Model REP-200T is priced at $1,145 in kit form; $1,395 wired and tested. The Model REP-200C is priced at $795 in kit form; $1,095 wired and tested. For more information contact *Hamtronics, Inc., 65-F Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.*

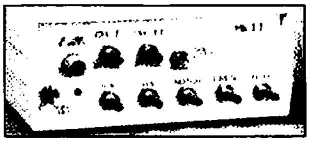
AMSOFT



AmSoft has released its new 1994 edition of "The World of Ham Radio" on CD-ROM. New this year is the inclusion of the FCC amateur radio license database. CALLSIGN will search over 700,000 new and previous callsigns, and find any licensed amateur in just seconds.

Users can view CALLSIGN on line or save to disk. Also new for 1994 is a front-end menu system called CD-VIEW. CDVIEW will operate the disk with simple onscreen commands, online help files, and instant information files from anywhere within the CD-ROM.

Over 7,000 program files cover many of the latest software releases for amateur radio. Subjects include antennas, CAT, CW, engineering, exams, formulas, logging programs, MUF, multimode, controllers, packet, RTTY, satellites, SWL, weather tracking, and much more. AmSoft has placed all of these programs onto one ISO-9660 IBM compatible CD-ROM priced at $40 plus shipping ($3 USA, $5 foreign). For more information or to order contact *AmSoft, P.O. Box 666, New Cumberland, PA 17070-0666; (717) 938-8249, FAX (717) 938-6767.* Or circle Reader Service No. 203.



CURRY COMMUNICATIONS

Curry Communications has introduced the MKII Noise Annihilator, a professional grade low frequency receiving processor. This receiver accessory will considerably enhance reception for low frequency communication enthusiasts at low cost.

Many hams and other radio enthusiasts enjoy monitoring the LF and VLF bands, receiving European longwave DX, aeronautical beacons, 1750 meters, and other signals of interest. The major drawback is noise. More sophisticated receiving technology is called for. At this time there are no other products on the market that provide the operator the control and dramatic improvement of this product.

The MKII removes noise ahead of the receiver, opening a new world of DX reception, particularly in urban and suburban environments. It is priced at $189 plus shipping ($5 US, $8 overseas). For more information contact *Curry Communications, 737 North Fairview Street, Burbank, CA 91505; (818) 846-0617.* Or circle Reader Service No. 205.

JUST NEON

Did you ever think of having your callsign in neon lights? Well, now you can! Just Neon has introduced its new Neon Call Signs to hams everywhere. These handcrafted works of art last for years and are made out of real neon tubing. Each character is 4" X 3" and signs come with complete instructions, mounting hardware and transformer, custom-made with your callsign.

The ultimate in shack decor is available in neon red, clear blue, orange, white, sky blue, rose, pink, or green. Your sign will be mounted between two durable sheets of clear acrylic, and comes with a one-year limited warranty. These signs are also available with a bottom accent strip, border, or other custom design.

The basic custom unit, tested and delivered, is priced at $225. For ordering information, please contact *Just Neon, 409 James Street, Utica, NY 13501; (315) 724-9150; Fax (315) 792-9032. Or circle Reader Service No. 206.*

Number 27 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Coincidence?

A week after I submitted last month's column about missing children, I received a press release in the mail. It is from an organization called The Friends of Mark Himebaugh Foundation, and the coincidence of it arriving shortly *after* I wrote last month's column is spooky.

Mark Himebaugh, whose picture is presented on this page, disappeared from the area of Cape May, New Jersey, on November 25, 1991. A massive search and investigation have turned up nothing. Mark is still missing.

Mark's father, Jody Himebaugh, is KB2QCJ. The press release I received (printed in its entirety in the April issue of *Radio Fun*) stated that Jody had formed The Friends of Mark Himebaugh Foundation for the purpose of heightening and maintaining national public awareness of missing children. Jody Himebaugh has asked hams to help in some simple ways.

"Whenever QSL cards are mailed, include the poster of a missing child," Himebaugh stated in the press release. "During CW, packet and voice communications, discuss the issue of missing children and the crime of abduction. Transmit images of missing children when working SSTV."

Most states have a clearinghouse for missing persons where you can obtain posters, stickers (great for attaching to QSL cards) and other information concerning missing children in your area. You can also contact the National Center for Missing and Exploited Children, 2101 Wilson Boulevard Suite 550, Arlington Virginia, 22201. Their telephone number is (703) 235-3900.

I sent Jody Himebaugh an advance copy of last month's editorial and asked him to contact me, which he did. He sounds like an intelligent and thoughtful man. As someone who has never had to deal with personal tragedy anywhere near the magnitude of losing a child, I am always amazed at the inner strength of many of those who have. Jody Himebaugh strikes me as a man possessing immense inner strength.

We talked about the formation of Amateur Radio Child Search. We talked about what is and isn't being done to aid missing children. I shamelessly asked him to help organize ARCS in New Jersey, which he agreed to help do. We both agreed that nothing could be accomplished without the assistance of hundreds of hams all across the country. We agreed that the only thing we could do was wait until people had a chance to read the February editorial and see what kind of a response I received.

In the meantime, I promised Jody that I would publish his son's picture. There are over 50,000 people reading these words (closer to 100,000 if you consider that most copies of this magazine are read by two or more people). I want each and every one of you to take a long look at Mark Himebaugh's picture. Notice the red hair. Notice the freckles across his cheeks and nose. Look at the statistics concerning his height and weight and remember that he is now 2-1/2 years older. Those of you in the New Jersey area, try to remember where you were on November 25, 1991. Dig out your old appointment calendar or search through your journal. When you get on the air this month, instead of talking about what kind of rig you have, ask the ham on the other end if he has read this column. If not, tell him about Mark and send him a photocopy of this page (you all hereby have my permission to do that).

Somebody out there knows something. Somebody reading these words has seen Mark Himebaugh sometime in the last 2-1/2 years. If you have any information, you can contact the agency listed under Mark's picture, or contact The Friends of Mark Himebaugh Foundation at P.O. Box 551, Cape May, New Jersey 08204-0551. Their phone number is (609) 884-6275.

I have one last request for all of you. Pull out last month's issue. With this issue open to this page, reread last month's column. Every few sentences, stop and take a look into the eyes of 11-year-old Mark Himebaugh.

Now, tell me you're too busy to get involved. 73

Number 28 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

March is likely to provide excellent DX conditions during the month, with only a very few days rated at less than Fair (F). You can expect some erratic conditions on the HF bands during March 20th (first day of spring) and 21st, but recovery will be rapid. Virtually half of the month will exhibit good-to-excellent propagation for DX to all parts of the world.

Although we are approaching the lowest part of the Cycle 22 sunspot minimum, and lowest solar flux values in the past nine or 10 years, springtime conditions are usually quite good, even at reduced sunspot numbers and low flux values. Therefore, the following conditions should apply for Good (G) and Good-to-Fair (G-F) and Fair-to-Good (F-G) days:

10 and 12 Meter Bands

Occasional F2 layer openings toward South and Central America (also Europe-Africa openings and general north-south path openings to other parts of the world) during daylight hours. Don't expect much from these bands, but keep an ear open for a good day.

15 and 17 Meter Bands

Consistent DX from the Northern Hemisphere to countries below the equator on many Good (G) days. Short-skip openings will also be quite good for much of this month during daylight hours, and out to about 1,000 miles or so.

20 Meter Band

This will be your band of choice for DX and short-skip operations during daylight hours, and there will even be some good openings after local darkness into areas of the Southern Hemisphere. Short skip will be good out to 2,000 miles or so during the day. Also, consider some grey-line DXing around the sunrise and sunset hours (local time).

30 and 40 Meter Bands

These two bands will provide you with *DX from sunset to shortly after sunrise*. You may expect good signal strengths from the East, peaking between sunset and midnight, and signals from all other directions between midnight and sunrise local time. Daytime short skip ought to be favorable out to about 1,000 miles, and at night out to about 2,000 miles. High absorption between about 1100 and 1300 hours local time will depress band conditions, but won't cut them off entirely. 30 meters will act somewhat like 20 meters, and somewhat like 40 meters, exhibiting some of the best (and poorest) qualities of both.

80 and 160 Meter Bands

Fairly good DX conditions between sunset and sunrise to most parts of the world on evenings when the QRN is low enough for good copy. This is the time of year for thunderstorms and "atmospherics." Paths to the East will peak near midnight local time, and to other parts of the earth between midnight and sunrise. Daytime short skip will be nil to negligible, but nighttime short skip will offer respectable distances on both bands. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	20						15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U S S R							20	20				
WESTCOAST			40	40	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	20	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U S S R								20	20			

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20	20				15
PHILIPPINES	15							40		20		
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U S S R									20			
EAST COAST		40	40	40	40	40	40	20	20	20		

MARCH 1994

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 G	3 G	4 G-F	5 F
6 F	7 F-G	8 G	9 G	10 G-F	11 F	12 F
13 F-G	14 G	15 G	16 G-F	17 F	18 F-G	19 F
20 F-P	21 P-F	22 F-G	23 G	24 G	25 G	26 G
27 G	28 G	29 G	30 G-F	31 G-F		

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73 Amateur Radio Today

April 1994
Issue #403

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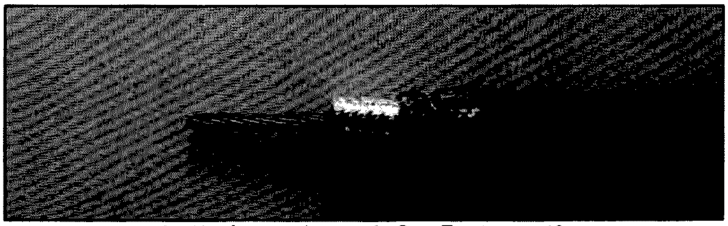

Looking for a good connection? . . . Turn to page 48.

DEPARTMENTS

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It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Why not combine ham radio with motorcycling? It's easy to do! Turn to "Motorcycle Mobile!" on page 10.

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Contract: By straining your eyes to read these tiny words you are hereby required to take a friendly pill. The next time you hear a newcomer on the air, give that extra effort to make him or her feel welcome.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Good Science, Bad Science

Have you gotten sucked in on some of the phony science scares? Like the acid rain baloney? Alar? How about the ozone hole panic or greenhouse effect? Nuclear winter? Since you've decided to elect lawyers with no science background to run our country, our science-ignorant Congress has been throwing billions at one ecoscam after another, urged on by a scientifically illiterate media and public. You should pay more attention to your old Uncle Wayne, who has been pooh-poohing these alarums and excursions for years.

At one time we were going to be overpopulated to starvation, bringing on a movement to limit families to two children. Remember zero population growth (ZPG)? And we were going to run out of oil by the end of the century. We were losing our topsoil. Our croplands were being paved over and we'd starve. We were using up our ground water. We're poisoning the oceans. We're killing the whales. Nuclear war would wipe everyone out. The Ice age cometh. Doom! And how about that virtually science-free Earth Summit last year in Rio and the dreaded freon and PCBs? All ecological disaster phony baloney. But very expensive baloney.

We're still being warned about pesticides, non-renewable resources, pollution, genetic engineering plagues, toxic wastes, landfills, and endangered species. Oh yes, and some of our reason-challenged religious fanatics are expecting the end of the world any day now. For the exact date, check with the Seventh-Day Adventists the next time they come to your door.

Yes, there have been some legitimate environmental concerns, but separating them from the spurious hasn't been one of our government's better accomplishments. In the last 30 years scores of new environmental laws have been enacted, complete with thousands of regulations. The government is spending over $130 billion this year on environmental regulation. The Environmental Protection Agency's budget has jumped 31% in the last four years and its staff has swelled by 23%. The federal budget for climate change research alone will be $1.4 billion this year! What a lovely piece of pork that one is! Pork you and I are paying for.

Presumably you're familiar with Veep Al Gore's environmental hysterics. I don't think he's ever seen an environmental scare that he didn't climb aboard and endorse.

60 Minutes does some fine investigative reporting, but every now and then they screw up seriously—like with the Alar scare and the accelerating Audis. Both turned out to be complete hooey, but you'd never know it from watching the program and waiting for an apology.

The really big money in all this is that collected by advocacy groups from concerned citizens, whipped into a frenzy of concern by the media. No amount of failed prophecies seems to discourage people from taking the next cry of doom seriously and sending checks.

Yes, some species are becoming extinct—just as millions have in the past. That's part of the survival of the fittest deal, which we accept as a rule of nature (God?). I haven't any problem with our trying to protect species which man is decimating, as long as we don't have the government doing it at our expense. The government, and that mainly means Congress, has an unblemished record of screwing up everything it does and costing us a bundle to do it.

The one thing nobody has figured out yet is how to stop us from re-electing the same crooks to Congress again and again. You're the one who voted in the crook who is wasting your money and screwing up your country for you.

Can anything be done about this mess? Of course, and it's not all that complicated. My recommendation is to get your state legislature to pass a law saying that any representative or senator from your state may not comment or vote on any legislation where he or she has a conflict of interest. A conflict would arise if any money or other benefits were received directly or indirectly from any party with an interest in said legislation. If other states passed similar laws this would cut off PAC and lobbying money, throwing tens of thousands of lobbyists out of work. It would give our politicians less money to spend on dirty-trick TV ads and maybe force them to come up with some proposed solutions to our problems instead of spending their campaigns astride fences.

"Can anything be done about this mess? Of course, and it's not all that complicated."

The media are in love with doom and gloom. "Good news does not sell papers" is the old and true saw, so the worse they can make things appear, the more papers they'll sell, and the higher the TV ratings. But in view of the almost complete failure to happen of every scientific disaster we've been warned about, is there any way I can at least get you to be skeptical the next time some scientifically ignorant journalist cries wolf? And that, unfortunately includes some scientists who should know a lot better, such as astronomer Carl Sagan and his nuclear winter campaign. Shame on you, Carl!

If you'd like to do some homework on this subject you could do worse than read *Ecoscam* by Ronald Bally; St. Martin's Press, 1993; 228p. Another book you'll enjoy is *Environmental Overkill* by Dixie Lee Ray; Regnery Gateway, 1993; 260p. Those'll give you more than enough to talk about on the air.

Those Pesky Anomalies

If you've been keeping up with your science basics you may have a vague grasp of how matter is put together. You know, all those atoms and stuff. Of course our scientists just couldn't leave things well enough alone—they had to go and try to take the atom apart. So they ended up with a growing mess of particles. Most stuff is made out of protons and electrons. And it's those pesky electrons which make it possible for us to have the displays in Las Vegas, and our radios.

Einstein made it bad enough, but then Planck and his lousy quantum theory really screwed up what had seemed pretty simple before that. Now, if you have kept up with the mess scientists have been making, you've got a rough concept of matter being made out of energy. This is how they came up with nuclear fission, and its practical application with the atom bomb and nuclear power plants. Then there's fusion, such as is keeping the sun going, and which peps up our atom bombs into fusion bombs. They're trying to harness the power of fusion, but not having any real success. Yet.

But the fact is that all this stuff around us is made up of atoms, and they're made up of energy. A whole big bunch of energy. What would be nice for us would be to find some way to tap into that energy, and be able to turn it on and off like a faucet. Now, while the cold fusion researchers have been having some amazing successes, there seem to be some other approaches which may allow us to tap into this energy. There are a number of hints on ways to tackle this. Scientists call these anomalies because they don't yet understand them and don't know how they work.

One way someone can make a billion or seven is to come up with a practical and inexpensive way to provide energy. It helps to be there first with something like that. That's the way Bill Gates got to be a billionaire—he had the first usable version of BASIC and sold it to the first microcomputer manufacturer—and then rode the wave from there on.

Hal Fox, in his December *New Energy News*, lists seven approaches to generating power that are being researched and show promise. Most of these are research projects that can be done on the cheap. It doesn't take $500 million a year the way they're spending on hot fusion. I've talked with experimenters who are spending more like $1,000 a year—and are having very serious positive results.

Pons and Fleischmann were pursuing an anomaly when they discovered that a mixture of palladium, deuterium, and lithium salts put out more power than was possible through any chemical reaction. Most scientists dislike anomalies and tend to dismiss them just by calling them anomalies. But for others anomalies are the key to discovering new things.

One of the more exciting aspects of my getting interested in cold fusion has been my meeting with scientists with open minds. What a pleasure! And what an enormous number of things there are that need to be investigated. There was a move to close the patent office a hundred years ago. Let's not close it yet. In fact, let's put on some pressure for it to be more in

Continued on page 92

LETTERS

Number 2 on your Feedback card

From the Hamshack

Glen Gercken NØPNQ, St. Charles MO I have been reading your magazine from cover to cover for about three years now. I enjoy it very much and have wanted to write to you many times.

The letter from Fred Carmichael KD4ATW (December 1993) is like a carbon copy of me. I have experienced the very same problems that he has.

I wholeheartedly endorse what he has said about licensing without the code requirement. If a young person is interested in electronics today he will go into computers and not ham radio. Ham radio could offer avenues for development of greater types of communication if only the code requirement were dropped to attract these young, talented people. The bottom line is: Do we want these people in the computer world or the ham world with computers?

Glen—Your point is well taken; but don't give up hope. In the March 1994 issue of Radio Fun, *Dr. Joseph H. Taylor K1JT said that ham radio is still an excellent training ground for young scientists. Taylor won the 1993 Nobel Prize in physics and said amateur radio was key in launching his career.*

Taylor said that technical knowledge remains at the heart of amateur radio and he had no objection to the no-code license. The fact is that there are more choices available for our brightest young people today. Anything we can do to bring amateur radio into the 1990s would help to attract more of them into our hobby. It seems only a matter of time before the code test takes its rightful place in the museum between the buggy whips and the slide rules.—Charlie WA1RZW.

Roman S. Makuch N2UCK, West Hurley NY In response to Randy KB7UIT's letter in the February 1994 issue, I also am a No-Code Tech. Instead of moaning and groaning about the FCC's insistence on requiring code to gain greater privileges, he should join a club and have one of the old-timers teach him. I have done that and will be attempting the 13 wpm element.

With the books that are published by numerous publishers giving the whole question pool, the written elements have been reduced to nothing more than an exercise in memorization. With my electronics background, I could probably pass the Extra Class element in my sleep. Getting a higher class license should be an achievement and not a joke.

By removing the code requirements, those who have advanced to higher licenses would have their accomplishments reduced to almost nothing.

If Randy ever decides to try some of the more difficult VHF techniques (eg. aurora propagation above 144 MHz), he will quickly find that without code he won't get through.

If the FCC reduces the code requirement to where it will be "so easy that it's just a nuisance," then they might as well just give out the licenses without testing at all.

Amateur radio is a challenging *hobby*, and as such I oppose reducing the requirements to the point where getting an amateur license becomes nothing more than a formality (read: JOKE!).

When people want to make something too easy and reduce other people's accomplishments it gets my dander up.

David S. Laustsen N3LHY, Doylestown PA 18901 *[Letter to Dean Frazier NH6XK, author of "My Longwire Antenna,"* 73 Amateur Radio Today, *September 1992.]* I read your article some time ago and decided to try to replicate it. My longwire is about 450 feet long and is made from #14AWG stranded insulated black wire from the local electrical shop. It has no coax—goes right out of the MFJ 986 tuner and out the second floor window—up to the top of a 50-foot tree and horizontal for about 400 feet. It is also an east/west wire with a slight bow in it. I have six radials for 160 meters and eight for 80 meters—all fanning out from the ground stake on the first floor. I run 100 watts RTTY/AMTOR/PACTOR and occasionally even SSB on all bands, and have no major RF problems even though I have a huge table of Macintosh stuff within four feet of the wire. I put a few snap-on RF chokes on some of the lines just to be sure, but no problem.

The performance of the antenna is very gratifying. People ask during QSOs, "Are you local?" or "Are you running a kilowatt?" I can break through pileups—almost with wild abandon—and I've worked just about everybody I can hear on the digital bands. Plotting out the major lobes of the antenna according to your tables, I can understand why I have had the DX performance that I have had.

This is a perfect antenna for those who have power lines in the front of the house—not enough room for a big doublet—and antenna restrictions on towers. We've had a lot of ice storms lately, and my friends on 2 meters were all complaining because they can't use their big beams—too much ice-induced SWR. I replied that the ice fell off my wire in about two hours, so I've been working DX while they're still trying to figure out how to get on the air!

I think that the end-fed longwire has had a bad "rap" from certain theoretical types who believe that all antennas must be balanced and have baluns—otherwise they have to be commercial beams.

Well, Dean, I don't know how much feedback you authors get on your articles, but my antenna is the best $20 worth of wire I've ever put up in the air—and I *thank you* for the idea. I recommend it highly.

I'm also a fan of *73* magazine and Wayne Green. He's amateur radio's voice of conscience and common sense.

Ted Stoforos N2MZJ, Long Island NY Wayne, PRINT THE HIV DEVICE SCHEMATIC! Use whatever disclaimers the shysters recommend, just do it. This is my (un)biased opinion. I do not have HIV, nor do I know anybody who has it.

The medical oligarchy and the drug monopoly need a good swift kick in the pants. Searching only for a chemical cure is their prerogative—after all, it's their money they're spending—but when they start interfering with independent research and other people's grants, that gets me mad.

As for losing a few pages of *73* next month, so be it. After all, some sacrifices must be made to keep the "free" in freedom of speech. Besides, would a man who has his ham radio budget planned for the next two years miss yet another product review? Would a ham who has four or five active projects on the bench miss another construction project? I think not. If challenging orthodoxy is the task, then a free press is the tool, and a well-informed, open-minded audience is the raw material.

You have the tools and the materials. Get to work. Of all people, you know how important it is to upset *this* apple cart. HIV is mankind's biggest and deadliest challenge yet. Your *73* readers and fellow hams (except the brain-dead) also know it. Of course, they will be right when they argue that *73* is not the correct place for this, but they're not thinking broadly enough. They're missing the point, because the very root of the problem is that the appropriate scientific journals won't publish this kind of unorthodox stuff.

I have read your rumblings for 2.5 years now, and you haven't turned me off yet. I get angry sometimes and rally with you (like now) and I try to do something about it. I get off my backside and get more involved in ham radio, build something, help someone, whatever. You help me to stay out of a rut, and remind me to reach out and to expect more from myself. Thank you and keep it up!

I read *73* from cover to cover, the very day it comes, and I occasionally read some of the other stuff between "Never Say Die" and "Random Output," too!

I agree that anyone who sues over a ham-related (non-business) dispute is scum. If you have to go to the courts to settle a problem involving your hobby, something is *very* wrong with your priorities.

When I first became a ham, I had trouble believing that any ham would deliberately sour another ham's enjoyment of the hobby by causing malicious interference and disrupting communications, but I hear all too much of it lately. Our weekly 2 meter ARES net gets jammed every now and then, and just last weekend somebody left a NON signal on our 440 repeater's input for over an hour. Stupid . . . you bet. But very motivating, for now I am trying my hand at direction finding antennas, phasing cable, deep nulls, step attenuators, and bunny hunting. I have read about this stuff for years and never tried any of it. It is hard to get it right—even though I know exactly what is *supposed* to happen, and how it is *supposed* to work, it often doesn't work, and never works the first time. It's a nice challenge, but I hope I don't *have* to DF too often.

Jim Rindfleisch Wayne, I'm an ex-broadcast engineer whose career has taken me in other directions. For years I've been reading your column and at last have decided to get off my duff and answer your request for information on what I do and don't like.

What I don't like: I'm a shortwave listener, not a ham, and for that reason feel compelled to offer a few observations from the outside looking in. First, it's a shame what has happened to the amateur bands, with the name-calling, carrier-throwing, profanity, VFO swishing and other types of behavior that not so long ago was restricted to the citizen's bands. As we all know, the radio spectrum is very crowded and space is valuable. If this resource is not well used it's not hard to imagine even more of the ham spectrum being given over to other more responsible users. The real shame about this is that I'm sure the offending operators are a minority that will eventually spoil the whole pie for everyone else. I'd hate to see the amateur bands restricted to a few noisy frequencies no one else wants because those who use it can't behave.

73 Amateur Radio Today is excellent, but in my opinion the best part is your column. I can't say I always agree, but your opinions are always well thought out.

Now, about equipment. Since I don't have a ham ticket I'm not sure I qualify, but as I do subscribe I'd like to pass on some observations on equipment. I use an ICOM R71A for shortwave and an ICOM R7000 for 'most everything else. Both radios have many hours on them and have never given me any trouble. They are as sensitive as the "professional" receivers and, with a computer interface and a wideband spectrum analyzer, much more useful. What I don't like is the extra converter that must be had for the computer interface with the R71. I guess into everyone's life some rain must fall.

In closing, I want to say thank you for what you've done for amateur radio, even from those of us who choose to "lurk" but not talk. Keep up the good work!

[Editor's Note: The following is a letter sent to the chairman of the Dayton Hamvention, a copy of which was sent to the 73 offices.]

Mr. Dave Grubb, Chairman
Dayton Hamvention
Dayton Amateur Radio Association, Inc.
Box 964
Dayton OH 45401-0964

Dear Dave,

I am one of a contingent of hams from Mobile that planned on flying to Dayton for the Hamvention. I had not planned on renting a car but anticipated using the shuttle bus service from the hotel as in prior years. I have just called your information number and learned that the Dayton Hamvention will not have shuttle buses running from the area hotels to the Hara Arena site this year. I also heard that the large parking area immediately adjacent to Hara Arena will not be available for parking this year. With the decrease in available parking, the decision to not have shuttle bus service to area hotels seems like a *very short-sighted decision*. The traffic problem at the Hamvention already is out of hand. With significantly decreased parking and no shuttle bus service from the hotels, I think you are headed for a disaster. I can tell you that if the Hamvention attendees have to spend 2 hours getting to the Arena and 2 hours getting back to their hotels each day you are going to have a *huge* controversy on your hands.

I respectfully submit that you reconsider the shuttle bus decision. I am looking to hear from you on this before I order our tickets for this year.

Yours truly,
S. Felton Mitchell, Jr.

QRX . . .

Number 3 on your Feedback card

RF Hazards

The FCC is considering new rules which could require radio amateurs and others to show they comply with certain standards of radio frequency radiation safety. Those guidelines have been recommended jointly by the American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers (IEEE).

The Commission's proposal raises complex engineering and public health issues. Compliance could cost in the millions.

For the last decade, the FCC has required commercial broadcasters to prove their operations do not expose their employees or the public to RF radiation in excess of the ANSI standards. Until now, amateurs have been exempt from these regulations. In addition, the guidelines were updated in 1992 and the FCC may decide to adopt these much stricter standards.

At press time, the Commission had extended the comment period on Docket 93-62 three times at the request of various industry groups. *TNX W5YI Report, Issue #3, February 1, 1994.*

Research and Development Growing

The Clinton Administration's proposed 1995 budget includes increases in allocations for a variety of electronics and information technology research and development projects. If the package remains intact, it would increase federal support for R & D to $73 billion, a three-percent hike over 1994.

Officials predict the shift from military to civilian R & D spending will reach parity by 1998—a time frame called too slow by Congressional critics. Research spending was kept afloat at the expense of so-called "big science" projects, however. Cuts included the superconducting supercollider—cancelled by Congress over White House objections—the space station, and a fistful of big-ticket weapons development programs. *TNX Electronic Engineering Times, Issue 784, February 14, 1994.*

Shuttle Ride Was a GaAs

If you have ever built a project utilizing a GaAsFET, varactor, or diode, you already know the value of semiconductor devices made with gallium arsenide. Now the market for gallium arsenide could go sky high after the February flight of the space shuttle *Discovery.*

Astronauts conducted epitaxial thin-film growth experiments in what NASA calls the Wake Shield Facility—a 12-foot-diameter stainless-steel disk used to create an ultra-vacuum in space for epitaxial growth of these GaAs thin films. The vacuum created was designed to be thousands of times more effective than the best laboratory could create on Earth.

A consortium of high-tech companies, universities, and government laboratories is sponsoring the program, which is projected to continue through 1997. If successful, devices grown in space could find applications in digital cellular phones, high-definition television, fiber optic communications, opto-electronics, and perhaps your next home-brew project. *TNX Electronic Engineering Times, Issue 783, February 7, 1994.*

This is Only a Test

One more relic of the Cold War is quickly fading into obscurity. The FCC has announced it is dismantling the 42-year-old Emergency Broadcast System and replacing it with a new computer-based system.

Under the EBS, a daisy chain of phone calls among officials and broadcasters was designed to get the word out to the public. Under the new system, emergency broadcasts will be computerized and automatically sent to radio and TV stations, cable systems, and satellite operators. *TNX The Independent Repeater Association's "The Purple Crystal," No. 36, February, 1994.*

Once And For All

The ARRL has petitioned the FCC to make amateur radio operators' licenses valid for the life of the holder. The League said in its January 6th petition that there is nothing in the Communications Act of 1934 that would prevent a lifetime license term for amateurs, and said the measure would allow inactive amateurs to return to service at the same class of license without retesting. The League says the number of amateurs who could stand to benefit from a lifetime ticket is significant.

Under the current 10-year license structure, the League says it is already possible for relatively inactive hams to remain licensed during periods of extended inactivity. The ARRL says there is no practical difference, then, between such a person and one who allows his or her license to expire and later wants to return to amateur radio. Currently, there is only a two-year grace period under which a lapsed license can be reinstated without the need for re-testing. *TNX Westlink Report, No. 665, January 24, 1994.*

Try, Try Again

By the time you read this, the Earthwinds Hilton around-the-world balloon project may be launched for the fifth time! Hams around the world are looking forward to working the capsule simplex on 145.55 MHz. Launch attempt #4 took place in January. Shortly after a seemingly perfect liftoff from Stead Field Airport in Reno, Nevada, the flight was doomed by a frozen vent valve, and the balloon had to land in an open field just west of Fresno, California.

In a previous attempt a surprise temperature inversion layer prevented the craft from gaining enough altitude to clear the Sierra Mountains. At each attempted flight, ham radio operators on the ground were instrumental in maintaining safety communications for the mission. Two of the three crew members are licensed hams.

Still, after four failed attempts, organizers and crew remain optimistic. If successful, the Earthwinds balloon is expected to circle the earth following the jet stream in 12 to 21 days. *TNX W5YI Report, Issue #3, February 1, 1994; Radio Fun, Issue 28, November, 1993.*

TAPR Has Moved

Tucson Amateur Packet Radio has relocated to new offices. The new mailing address is: Tucson Amateur Packet Radio, 8987-309 E. Tanque Verde Rd. #337, Tucson, Arizona 85749-9399. The voice telephone number is (817) 383-0000; FAX (817) 566-2544. *TNX W5YI Report, Issue #3, February 1, 1994.*

For Sale: Big Transmitter

If you've got a few extra million collecting cobwebs in the bank perhaps you'd like to bid on a really big station which is now up for sale in Central America. The Voice of America has announced it will entertain offers for its broadcasting facilities in Belize.

The sale is necessary due to budgetary limitations during the 1994 fiscal year. The Belize relay is located at Orange Point on the Gulf of Honduras, southwest of Punta Gorda. The station is equipped with two 100 kW MW transmitters, two directional antenna arrays, an on-site diesel power plant, satellite terminal equipment, control and monitoring equipment, and associated buildings. The facility is located on 240 acres leased from the Belize government. *TNX Amateur Radio Action, February 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on CompuServe ppn 70310,775@compuserve.com; or at the *73* BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one-stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

Number 4 on your Feedback card

Motorcycle Mobile!

Take ham radio two-wheeling.

by Irwin W. Fisk KC6QJB

The most frequent complaint of those traveling with VHF/UHF rigs is the indifferent reception they often receive when keying up repeaters in unfamiliar areas. A new legion of hams is finding, however, that this does not apply to them. Instead, they are experiencing the thrill of creating pileups. Motorcycle mobiles represent one of the hottest new trends in ham radio.

Ray Davis KD6FHN is president of MARC (Motorcycle Amateur Radio Club). Davis and two fellow MARC members recently rode their Honda Gold Wings on the Four Corners Ride from San Ysidro, California, to Blaine, Washington; Madawaska, Maine; and Key West, Florida. "It was amazing," says Davis, "There were repeaters, except for wide-open spots in Montana and South Dakota, all the way to Maine and down the East Coast. As soon as I would go on the air with 'This is KD6FHN, motorcycle mobile, looking for local information,' hams would start asking me all kinds of questions . . . we would talk for hours. It was this way from one town to the next."

"The interest in MARC is phenomenal," says Davis. "In less than a year we have picked up over one hundred members." Members donate hundreds of hours each month by riding herd on charity walks, runs, and bicycle rides. A callsign is not a prerequisite for joining MARC, but all of the members are licensed hams. Most were motorcyclists first, and now see ham radio as an enhancement to their enjoyment of riding. Others, like Billy Hall N6EDY, enjoy the fun of trying something new. "I've been licensed since about 1960, and I had tried about everything in ham radio. I heard about this, and I thought great, now I can enjoy both hobbies."

Their rigs run the gamut: handhelds adapted to motorcycles, single-band mobiles, dual- and triband mobiles, 10 meter HF rigs, even a Kenwood TS-50S. Several members have both HF and VHF/UHF capability. Danny Velderrain KD6FLP mounted his 10 meter Ranger RCI-2950 on a crosspiece between his handlebars, and he alternates between his Alinco DJ-102 and Yaesu 50 watt mobile for 2 meter work.

A No-Code Tech often selects a handheld for his first radio—an easy installation for use on a bike. The key component is a speaker/microphone such as Comet's ML-7. The ice-cube-sized unit has two leads that plug into the speaker and microphone jacks of your handheld. Attached to a third lead is a small earpiece that acts as both a speaker and a microphone. Its PTT button allows you to switch between send and receive. The ML-7 is easily attached with a bracket or tape near the left-hand grip, and the antenna can be easily attached via coax to the connector on top of the handheld. Members with handhelds often connect their rubber duck antennas to an adapter, such as the Realistic Suction Cup Accessory, 17-314, made by Radio Shack. This adapter has two side-mounted suction cups near its base. The suction cups stick easily to the windscreen, thus making it ideal for quick setup and takedown.

If prolonged use is anticipated, the rig can be powered by connecting the power leads to the bike's battery. The radio can be nestled into one of the bike's up-front compartments or it can be mounted with Velcro so it can be easily detached for off-bike use. MARC members report working each other on simplex up to 10 miles with their handhelds, 5 watts, and their adapter-mounted rubber duck antennas.

The miniaturization of ham radio is a boon to motorcycle installations. One of the newer innovations is the detachable face feature of some VHF/UHF mobile radios. The small face mounts nicely in front of the rider while the radio tucks safely out of the way in the luggage compartment. If you are installing a dual- or tribander, you can also mount the duplexer or triplexer unit in back with the radio. Antennas can be mounted on the luggage rack, if properly grounded, or in any other convenient rear location. In the case of Gold Wings, several MARC members have replaced their stock issue AM/FM antennas with VHF/UHF models.

The small Kenwood TS-50S is already finding its devotees in motorcycle amateur radio. Ray Davis mounted his TS-50S HF unit in tandem with the face of his Kenwood 741-A VHF/UHF tribander. This gives him a previously unheard of number of HF, VHF, AND UHF radio bands in a foot-square space. Davis connected his Kenwood 741-A to a triplexer that in turn connects to his Comet 224 triband antenna. He connected his TS-50S to a fold-over Comet CA-HV multiband antenna that is mounted on his luggage rack. The CA-HV also works on 2 meters along with the HF bands.

These new detachable-face radios don't preclude one from installing a full-sized mobile rig. Standard mobile radio brackets, secured with sheet metal screws or bolts, can be used for most mobile rigs. You will need

Photo A. MARC members proudly show off their ham-radio-equipped motorcycles.

Photo B. The ML-7 miniature speaker/mike accessory from Comet allows you to easily adapt your HT for motorcycle mobile use.

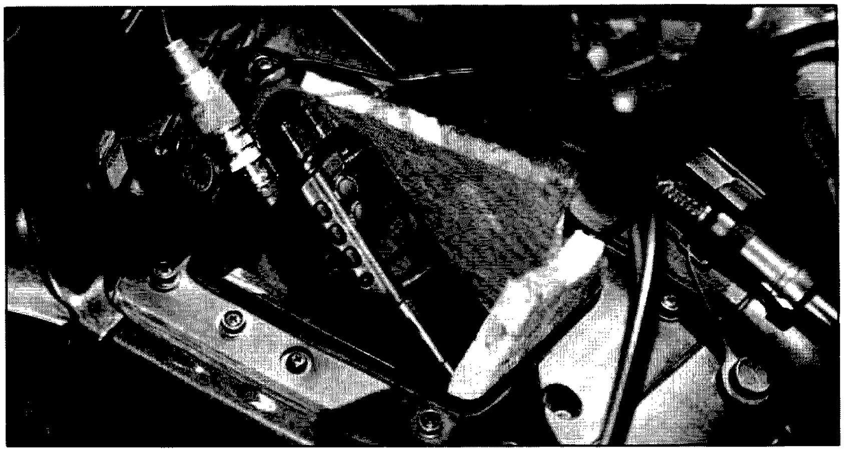


Photo C. This simple handheld installation can be easily removed to prevent theft.

metal straps to secure the larger radios. You may want to think about the security of your radio before choosing a rig for your bike. The detachable-face radios are less vulnerable to theft, but they are more expensive.

Most rigs are powered by connecting the radio's power leads to the terminals of your battery, but make sure the in-line fuses are in place. This arrangement works fine while the engine is running, but motorcycle batteries are small and not conducive to powering long-winded QSOs while the engine is off. Several MARC members report they operate their mobile rigs on low power to prevent excess battery drain.

VHF/UHF antennas, because of their small size, can be easily mounted nearly anywhere in the rear. Most MARC members install their antennas onto their grounded luggage racks.

HF mobile antennas need to be of a manageable size for motorcycles. Whips can be used for your favorite band, but a multiband such as the Outbacker or Comet's CA-HV will be required for multiband HF work. Most Outbackers will cover from 10 through 75 meters. The CA-HV will cover 2, 6, 10, 15, and 40 meters. A 20 meter loading coil is also available. Make sure the base of the antenna bracket is grounded to the frame of your bike.

The speaker and microphone arrangements are the most problematic aspect of motorcycle radio installation. You have several choices: 1) use the standard mobile radio speaker/microphone arrangement where the microphone hangs on its mounted bracket until you need to reach for it; 2) use the in-your-ear speaker/microphone arrangement discussed earlier in this article; 3) integrate the speaker and/or microphone into your helmet.

The first option has the advantage of being easier to install, but has the disadvantage of outside noise distraction to your speaker. On the plus side, many of the newer rigs have frequency and volume controls built into the microphone.

The second option, the ML-7 or its equivalent, works but reportedly lacks the speaker fidelity of a normal-sized speaker. The ML-7K is needed for use with Kenwood radios. This option works best when handhelds are utilized as mobiles.

Integrating the speaker into the helmet is more complex on the installation end, but makes for a more comfortable mobile operation. One of the simplest methods, used by several MARC members, is to buy Radio Shack's Compact Disc Cassette Adapter #12-1951. It looks like an ordinary cassette tape, except that it has a wire attached to it. They insert the "tape" into their bike's tape deck. The end of the attached wire plugs into the speaker jack of the radio. The audio of the radio feeds through the tape deck into the existing helmet speakers or the bike's external speakers. Member Billy Hall advises setting the ham radio volume on low and controlling the volume with the tape deck's volume control.

Several members of MARC have installed small helmet speakers, such as those made by J&M in the helmet. This speaker, of course, connects directly to the speaker jack of the radio.

Once you have installed your rig on your bike, you are in for an enhanced ham experience. Danny Velderrain sums it up: "When you mention you are a motorcycle mobile, everybody wants a piece of you."

MARC's contact person is Ray Davis, President, 3 Lindberg, Irvine CA 92720; (714) 551-1036. MARC HF nets meet every Tuesday evening: 000 UTC on 14.260; 0100 UTC on 7.250. The VHF net meets Wednesday at 8:00 p.m. PST at 146.985.

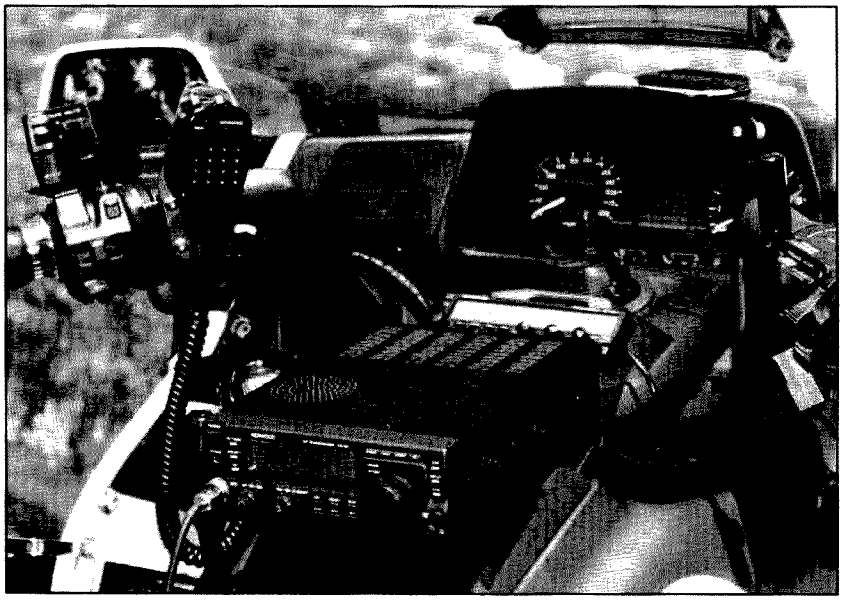


Photo D. What else could you ask for? KD6FHN operates motorcycle mobile with his Kenwood TS-50S (foreground) mounted in tandem with his Kenwood 741-A (faceplate in background).

Photo E. MARC members Ray Davis KD6FHN and Danny Velderrain KD6FLP are deep in a forest of motorcycle mobile antennas.

The 40 Meter Full-Wave Horizontal Loop

Take your signal to the treetops.

by Dean Frazier NH6XK

If you have the space to put up 142 feet of wire in a closed loop configuration, and you desire 10-80 meter operation, including the WARC bands, the 40 meter full-wave horizontal magnetic loop may be just what you're looking for. It doesn't have to be square, out in the open, or very high off the ground to perform well.

My 40 meter loop averages 35 feet in height (about 1/4 wave high on 40 meters), and yields 5-9 signal reports to middle America and 5-6 reports to the East Coast from my QTH on Oahu, Hawaii, with 100 watts. The loop gets 5-9 to 10 dB over into VK and ZL, across open water, and this despite the fact that (1) the loop is buried in and amongst trees of a forest, (2) the loop is not at all square, and (3) my feedline (50 ohm coax terminated with 22' 6-5/8" of 75 ohm coax, velocity factor 0.66, giving 1/4 wave on 7.2 MHz) is almost 300 feet long.

I use #12 AWG copper wire, PVC covered, and I do not use a balun. A 1:1 current balun (inductive coupling) can help to reduce RF signal pickup and re-radiation by the coax braid, but I suggest not using a balun for multiband operation unless the balun is very broadbanded (low Q) lest you burn it up at high reactance levels on frequencies other than the design band. I do cancel RF at the feed point with eight turns of the coax wound to a diameter of 6", taped together as a "coil" or RF air choke.

All antenna attachment points are via 1/8" nylon line terminating in a 3" loop of spaghetti tubing. I avoid direct contact with trees because this seems to increase the antenna's noise level on receive and also seems to cause some degradation of transmitted signal due to energy absorption into the trees (see Figure 1 and Table 2).

On bands other than 40 meters I use a matchbox (L/C circuit) to tune out reactance and help keep the SWR down to allow full power transfer. Some form of magnetic coupling in the transmission train from rig to antenna helps to suppress harmonics which can cause TVI/RFI, so a tuner, no matter how simple, is suggested, regardless of whether it is needed for impedance matching or reactance tune-out.

The feed point mechanical construction consists of a strip of plastic (a 2" PVC strip cut down the middle to make a "plate" or strip, about 9" long) to which is mounted, via plastic ties, an SO 239 connector. One end of the antenna wire is soldered directly into the SO's center conductor; the other, after making its way around the forest through the trees, is attached to the braid side of the PL connector of the coax (now screwed onto the SO connector) by a small hose clamp. (See Figure 2). The plastic strip is hoisted up into the trees by nylon line thrown up previously. I use the "weight and string" method of getting lines up into trees. Some fast

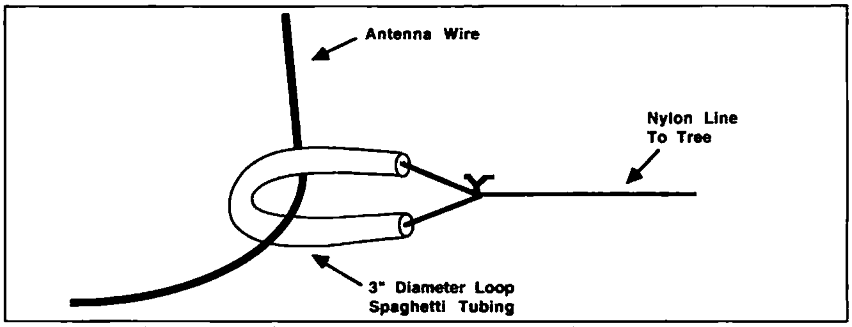


Figure 1. Attaching the nylon support line(s) to the antenna wire.

Band (meters)	Frequency (MHz)	# Waves (on wire)	Gain (dBd)	Feed Point (resistance, ohms)	Wave Angle (degrees)
10	28.500	4	+5+	140	10
12	24.940	3-1/2	+5	130	
15	21.225	3	+4+	125	13
17	18.118	2-1/2	+4	120	
20	14.200	2	+3+	110	15
30	10.120	1-1/2	+3	100	
40	7.150	1	+2+	90	30
80	3.750	1/2	+1+	60	

Table 1. 40 Meter Full-Wave Horiontal Loop (142 feet of #12 PVC covered copper wire) at 35 feet.

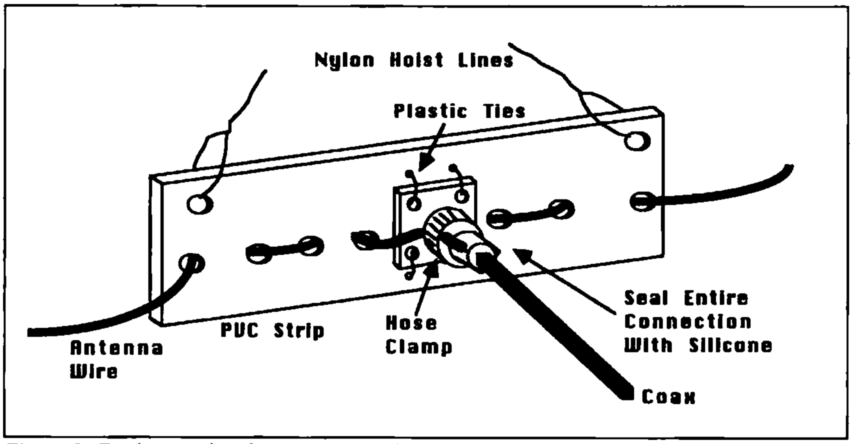


Figure 2. Feed point detail. Wire strain relief is provided by first threading each end of the loop's wires through three holes each about an inch apart, on each side of the S.O. connector, before electrical connections are made.

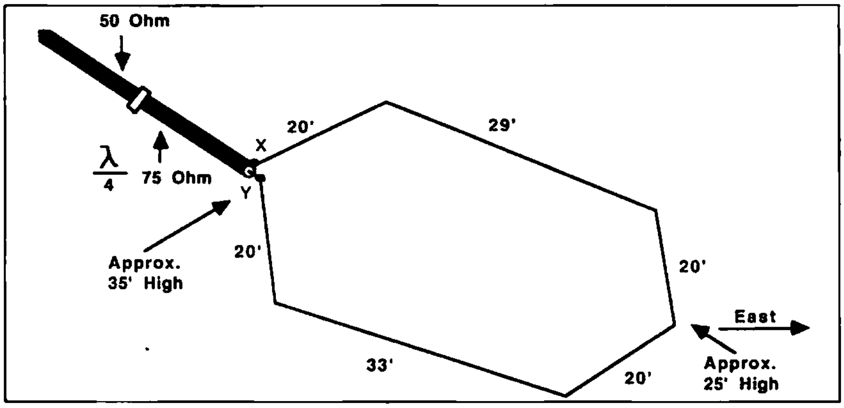


Figure 3. A view of the 40 Meter Full Wave Horizontal Loop.

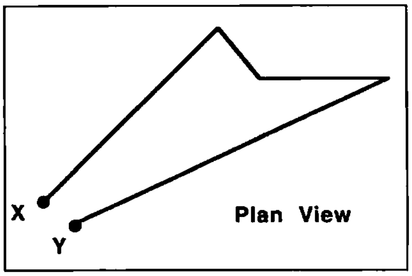


Figure 5. Internal angles of less than 90 degrees can cause signal cancellation problems.

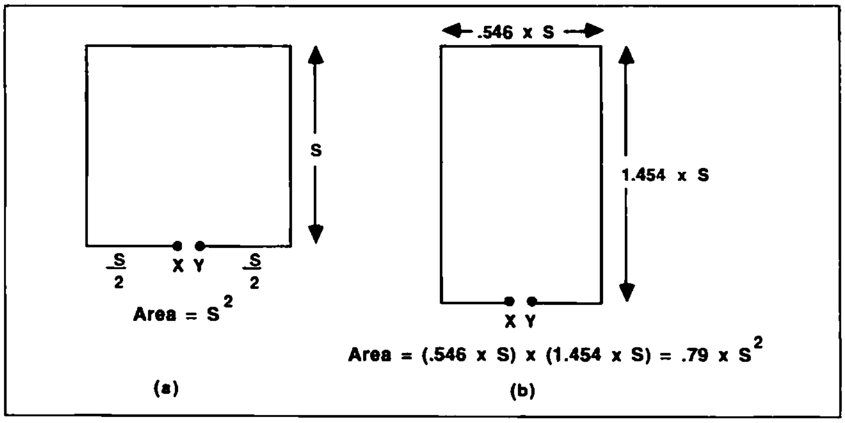


Figure 4. You don't have to make the loop square to make it work well.

twirling and a hard launch at the right angle can put a 4 oz. lead weight with light line some height up. A fishing rod/spinner works well also.

Lots of line throwing, tree branch trimming, climbing, sweat and hard work may be necessary in a thick forest to get the loop up and clear of small branches, but then again, in a clear area some supports for the antenna would be required, and it takes work to put them up, too. So, as long as you can avoid near ($\lambda/2\pi$) field proximity to large (over 6") limbs, the loop will work almost as if the forest weren't there . . . e.g. on 40 meters, try to stay 22 feet away from large tree trunks, 12 feet on 20 meters, etc., otherwise a significant percentage of energy will be absorbed by the trees, resulting in reduced primary signal strength (see Table 1).

Concerning gain and enclosed areas, realize that a square loop (each side 1/4 electrical wave long, all corner angles 90 degrees) has a bit more than 2 dB gain over a dipole at the same height over the same ground. For a not-square loop to lose 1 dB in signal strength compared to a square loop (a just barely detectable audio difference), its enclosed area has to be reduced about 79% of that of a square:

10log (0.79) = -1 dB

The signal from the loop in Figure 4B will be about 1 dB less than that from the loop in Figure 4A.

The point of this geometrical digression has been to show that you don't have to make the loop square to make it work well; just avoid making (if rectangular) the short side less than 0.546 x the length of a square loop's side.

Example:

Total wire in loop = 1005/f(MHz) feet.

40 meter loop wire = 1005/7.077 MHz = 142 feet.

If square, then each side length = 142/4 = 35-1/2 feet, but not less than 0.546 x 35-1/2 = 19-1/3 feet.

Avoid internal angles less than 90 degrees. Don't use a design like that in Figure 5, for obvious reasons of signal cancellation.

If you desire stronger propagation in a preferred direction, angle the plane of the loop toward the desired direction in a sloping loop (or diamond) configuration (see Figure 6).

But if you do make the loop into a diamond shape and slope it, don't let the short width (across) become less than 0.885 x the length of a side when square (see Figure 7).

Specifically, for 40 meters, a sloping diamond would look like Figure 8 (The sketch shows the minimum width and maximum length allowable before the loss resulting, compared to that of a square loop, exceeds 1 dB).

Comment: My 80 meter SkyLoop (282 feet of wire, another antenna) enjoys the advantage of both horizontal and vertical polarization, as half of the loop (the west half) is more or less horizontal, while the remaining east half slopes down into a gulch. The result is that the SkyLoop is effectively a sloping loop. It's plan layout is not at all square, but the short width is greater than 0.885 x the length of a square loop's side.

Always feed horizontal loops at their highest point. And note that a 40 meter full-wave loop is a half-wave vertical on 80 meters, the loop functioning as a capacitance

Continued on page 18

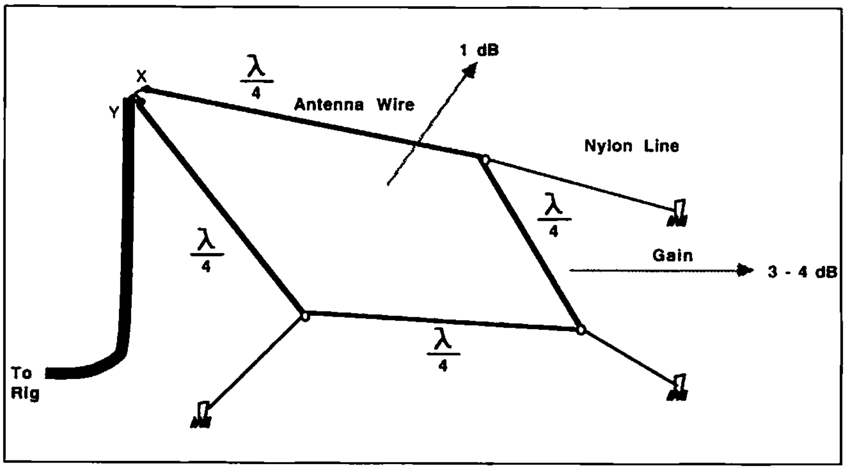


Figure 6. Directional enhancements are made by positioning the plane toward the desired angle.

The 40 Meter Full-Wave Horizontal Loop

Continued from page 16

hat for radiation from the vertical feedline.

Horizontal loops are easy to build, erect, and require no tuning if you cut the wire according to L = 1005/f (MHz) feet, where the frequency f is for the lowest band of desired operation. Feed the loop either directly with 50 ohm coax or with a quarter wave (electrical, considering velocity factor) of 75 ohm coax; again, the quarter-wave matching section's length is based on the lowest frequency of planned operation. Of course, tuned feeders may also be used.

For those who are unable to erect antennas very high, the 142-foot length of wire as a 40 meter full-wave horizontal loop about 35 feet above ground is a winner. And it doesn't have to be textbook square, or horizontal, to be effective.

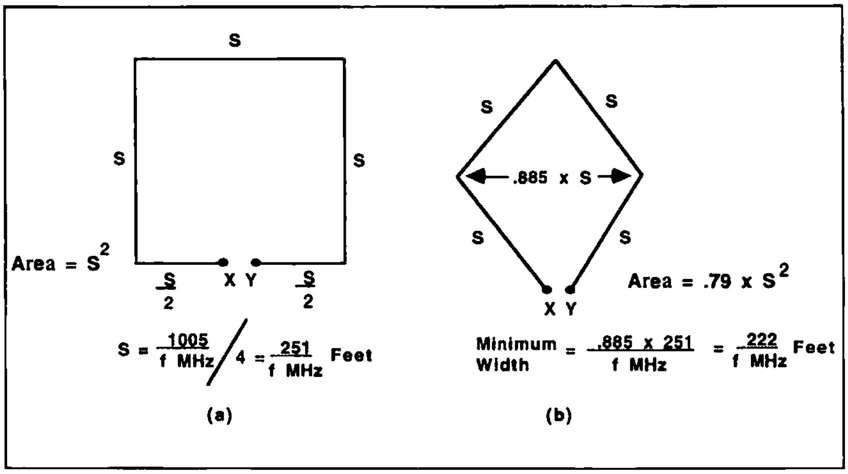


Figure 7. Don't let the short width (across) become less than 0.885 x the length of a side when square.

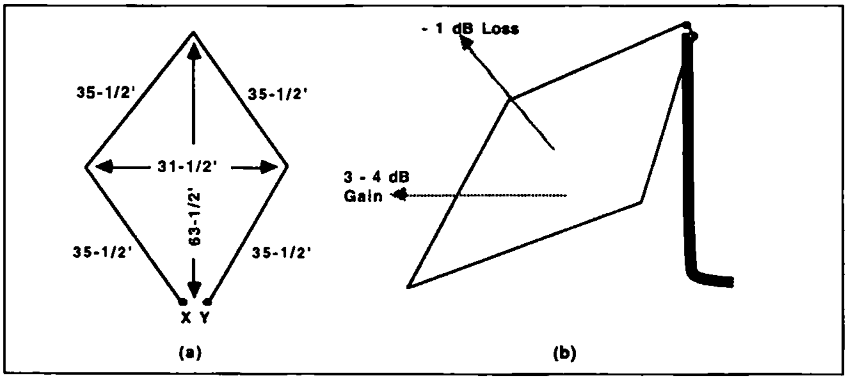


Figure 8. A sloping diamond for 40 meters.

Band (meters)	Near-Field ($\lambda/2\pi$) Clearance Distance (feet)
10	6
12	7
15	8
17	9
20	12
30	16
40	22
80	42
160	83

Table 2. When an antenna is within $\lambda/2\pi$ feet of a nearby object, such as a tree (a capacitor) or some metal (an inductor), being the free space wavelength at the frequency of operation (feet), primary signal attenuation occurs due to the energy of the near (storage) field being absorbed by the tree or metal. As a result, this energy is no longer available to reinforce, by ground reflection, the signal of the primary radiation. The loss can amount to as much as 6 dB. To avoid this phenomenon, keep all antenna wire at least these distances away from 6" diameter or larger energy-absorbing objects:

Number 6 on your Feedback card

The Big Kahuna

A 15' high, 160 meter Distributed Capacity Twisted Loop Antenna.

by Jim McLelland WA6QBU

If you're like most hams, you don't come close to having enough room for an antenna for our lowest band, 160 meters. Not being much different, I not only lack sufficient space for a low-band antenna but, like most cliff dwellers before me, I can't even put up an outside clothesline. So, I developed the Distributed Capacity Twisted Loop (DCTL) prototype on 40 meters (see *73*, September 1993, page 26) and then applied what I learned to a 160 meter version.

The result is a 15-foot-high equilateral triangle that you can hang on the side of your house or, like I do, from the balcony when the XYL isn't looking. It can be built in a couple of hours, doesn't cost much and, as the title (Big Kahuna) suggests, packs a real punch. If you've got room for a 10 meter dipole you've got room for this, so quit stalling, get out your soldering iron and go for it.

Description

The DCTL is a loop made from 300 ohm twinlead, but with a twist. To understand the "twist," look carefully at Figure 1. You'll notice that opposite ends of the loop do not connect to each other. This is a critical point in getting the loop to resonate. These open, opposite ends connect to a capacitive stub that does the fine tuning, but most of the tuning capacitance is distributed along the whole length of the loop. It is this capacitance that lowers the frequency of the wire loop so that about 1/8 wave will resonate instead of the usual 1/2 wavelength. In short, a loop about 50 feet long (15 feet across) has replaced a 246-foot-long dipole. The impedance drops drastically and must be raised back to 300 ohms. This is accomplished with a shorted "hairpin" stub impedance matching device across the feedline. The net result is a loop antenna resonated between 1.8—2.0 MHz with a 300 ohm impedance and a "Q" of 100. This produces a very narrow bandwidth of about 20 kHz. However, you can easily adjust the SWR to 1:1 over the entire 200 kHz, 160 meter band with a balun and tuner.

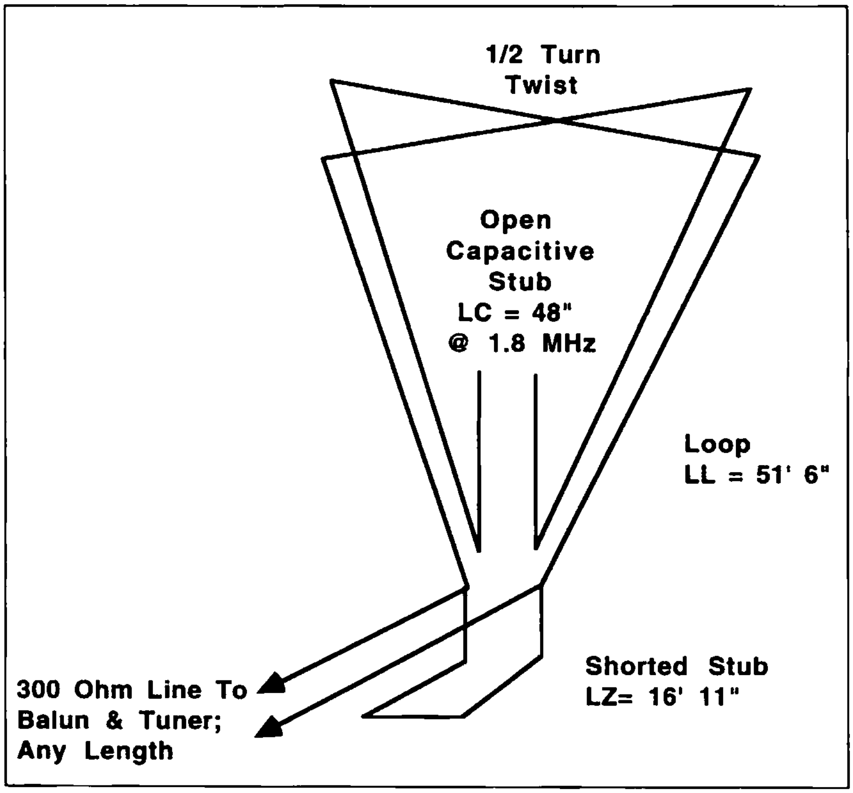


Figure 1. The Big Kahuna 160 meter DCTL dimensions.

Construction

The loop is cut for 2.0 MHz and the capacitive stub is made long enough to pull the resonant frequency down to 1.8 MHz. Then it is easy to trim the stub to anywhere in the band. All DCTL parts are made from 3/16" twinlead, available from Radio Shack (15-1153), or you can order a complete kit from Antennas West (see the Parts List). Either way, you'll have enough wire left over for some lead-in to the balun/tuner.

Figure 1 shows the lengths required. Remember, they are critical, so *measure carefully*. Twist together and solder all connections. Don't forget to put pieces of shrink tubing on all the leads *before* you solder anything! After soldering and insulating, the shorted "hairpin" stub (16'11") can be attached directly to the lead-in with shrink sleeving, or it can be rolled up into a 12"-diameter loose coil, or it can even be left to hang free. The antenna characteristics change a little from one method to the other, but they all work fine.

The open stub is quite frequency-sensitive. Keep it away from other antenna components and metal in general. If it can't hang freely, attach it to an insulator, such as a twinlead standoff.

The 48" length lowers the loop resonant frequency 200 kHz and its effect seems to be fairly linear. Before you do any trimming, however, complete the construction and install the antenna. You should do it this way because the shape also affects the frequency somewhat, with the resonant frequency going up as the feed point angle gets larger. The loop itself (51.5') *must* be connected so that there is *no continuity* (infinite resistance) between the terminals that connect to the feedline. Check and connect these leads before the shorted "hairpin" stub is attached.

Installation

If your operating location permits, mount the DCTL as an equilateral triangle or diamond, with the feed point down. If not, then go for the most area inside the loop that you can, given your situation. The DCTL will also work as a wide-spaced two-turn loop, but it's down about one "S" unit in comparison. You'll need to retune somewhat, but that's not difficult.

Be sure to use insulating material to support the loop. Nonconducting clothesline works well if beauty isn't important (I keep my odd-shaped creation in the attic). Those of you concerned with aesthetics can get by on an outside wall by following trim boards, using traditional standoffs, and painting your loop the same color as the house. Don't forget, though, that you must stay away from metal objects such as flashing, vents, and downspouts. This includes the lead-in itself. Also, if you have the choice, put the plane of the loop in your favorite directions as it definitely has deep broadside null points.

Tuning

The minimum equipment necessary to get this system working is an SWR bridge, a balun, and a tuner. Without the tuner, your bandwidth is only abut 20 kHz, but with it, you can QSY the whole band with no trouble. There are several "no tuner" options to QSY but they all require changing the effective length of the capacitive stub. You could make several stubs for different frequencies and attach them with banana plugs, or use a rotary switch, or even rig up a remote relay system. I've tried all of these and finally decided that while it was fun to experiment, the tuner worked just as well.

To resonate the loop, trim short pieces off of the capacitive stub until the SWR is where you want it. Remember that shortening the stub 24" moves resonance up about 100 kHz. The best way to check this all out is to use an antenna bridge. Then you can find the starting point and trim until you're in the middle of the band, or where you prefer to be. You may be somewhat below the band edge if your feed point angle is less than 60 degrees (equilateral triangle); with only an SWR bridge, it may be difficult to find the proper stub length. Trimming 3" at a time and checking for an SWR dip is the best procedure, remembering that each change will move the antenna up about 10 kHz. If you don't feel like doing this, cut the stub to 24", resonating the antenna somewhere in the band (hopefully the middle), and use your balun/tuner for the rest. I later discovered that the tuner would resonate the loop on every band down to 10 meters and my antenna bridge showed sharp resonant points on 7, 14, 21, and 28 MHz as well as on the design band.

Testing

Believe me when I say this thing works! I contacted stations out to about 700 miles with S9 signals both ways and my noise level was always below S3. Band conditions were bad and I could still hear northern stations over 1,000 miles away. I didn't try to work them as they were all in round tables and I hated to break-in since I couldn't hear everyone. I later figured out that they were broadside to the loop and in the general area of the null. A 90 degree turn made the north-south stations much stronger.

By the way, the locals tell me that there's even DX late at night! I can't wait.

Another thing to remember, and one reason why I developed this antenna, is that the sunspot cycle is still on the wane. There may be nights when 160 is the only band left working. I'll be ready! Will you?

Parts List

All parts needed to build this (160 meter) antenna, or the 40 meter model described in the September 1993 issue of *73*, are available in the "Compact Loop Experimenter's Kit." The parts are:

Twinlead - 5/16"	100'
Shrink tubing - 3/8"	1'
Shrink tubing - 3/16"	1'
Banana plugs	2
Dacron line	50'
Double split twinlead	
Insulators w/hardware	4

Introductory price w/shipping (40% discount for *73* readers): $24

Available from:

Antennas West
1500 N 150 W
Provo UT 84604
Tel. (801) 373-8425

Number 7 on your Feedback card

73 Review

by Jeff M. Gold AC4HF

The Lightning Bolt Quad

Lightning Bolt Antennas
RD #2 RT 19
Volant PA 15156
Telephone:(412) 530-7396
Price Class: $289 complete

An HF five-band, two-element, cubical quad antenna.

Most hams are familiar with that age-old wisdom: "Put your money into your station's antenna." It is nice to have a full-featured HF transceiver, but the antenna is much more critical. With a directional antenna you can effectively increase your signal strength and help eliminate signals coming into the back and sides of your antenna.

Quad or Not

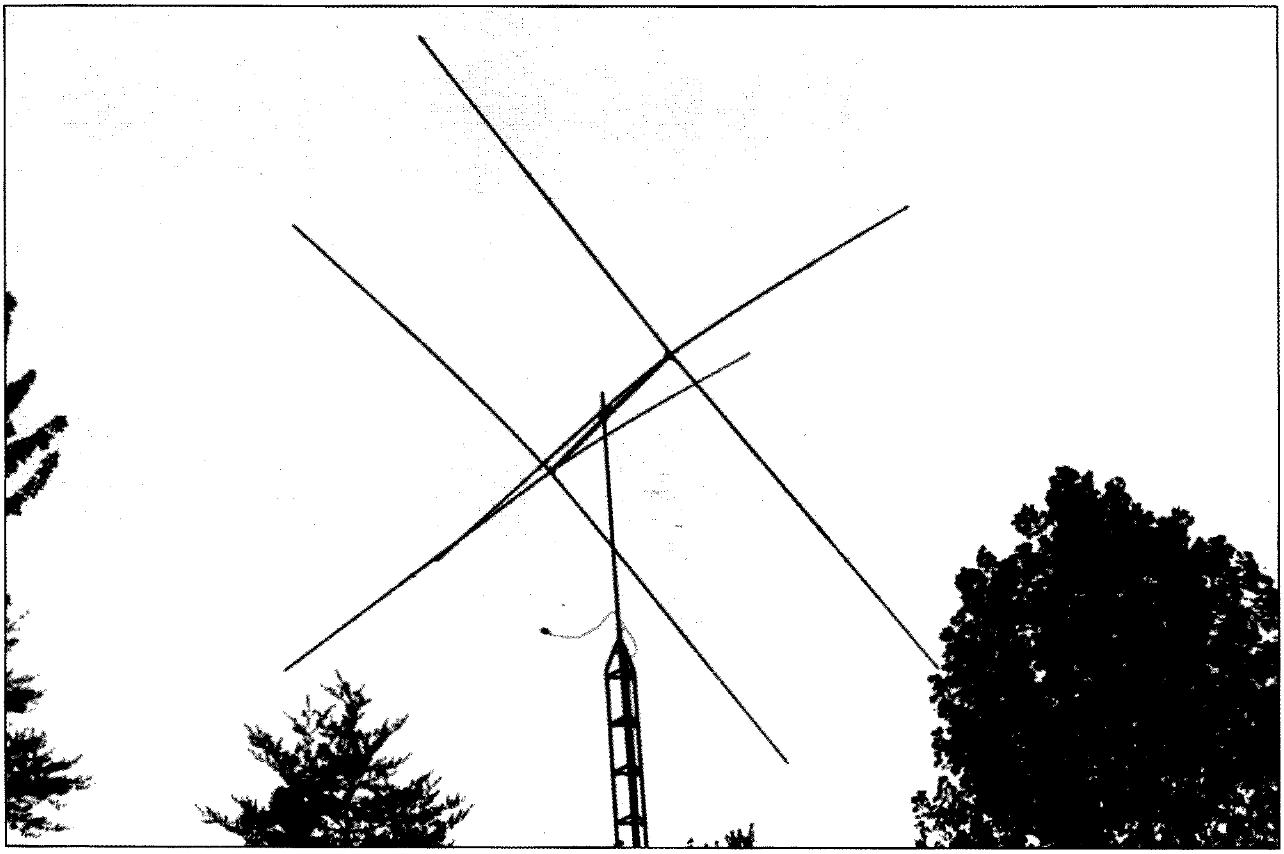
The two most popular types of directional antennas are quads and yagis. Up until recently yagis have been more popular. Quads had a reputation of not being as rugged as yagis, due to the construction materials available in the past.

A two-element quad has the same amount of gain and front-to-back ratio as a three-element yagi, and can be as effective at a lower height. Since the quad is a lower "Q" antenna than a yagi, the spacing between its elements is not as critical. The quad is also quieter with atmospheric noise than the yagi.

Lightning Bolt Antennas sells a two-element five-bander (covering 10, 12, 15, 17, and 20 meters). The antenna is designed to stand up to tough weather conditions. Lightning Bolt uses a special Fiberglas wrapping technique for the spreaders. The supports are made of heavy-duty welded aluminum and all the materials are top quality.

Building the Antenna

The instruction manual is five pages long. Most of those pages are taken up by diagrams. The first steps guide you through assembling the spreaders. There are 16 hollow Fiberglas sections. You take them in sets of two and adjust them to the specified length and secure them with hose clamps. The actual length is not critical; you just need to be in



Specifications

Gain	8 dB
Front-to-back	26 dB
Side lobe	50 dB
Boom diameter	2"
Turning radius	10.6'
Weight	35 lbs.
Arm length	12'9"

SWR Measurements

Actual SWR measure after installation using given assembly measurements:

10 meters	28.000	2.0:1
	28.200	1.7:1
	28.300	1.5:1
	28.500	1.12:1
	28.700	1:1
	29.000	1.2:1
	29.700	1.6:1
12 meters		1.5:1 or better
15 meters		Better than 1.4:1
17 meters		1.5: or better
20 meters	14.000	1:1
	14.100	Better than 1.2:1
	14.350	1.2:1

the ballpark. You next attach the spreaders to the metal spider using some more hose clamps.

The first element to work on is the reflector. You take wire holders and attach them along the length of each spreader at given distances from the center of the spider. You need to be close on your measurements, but not exact. You will end up moving these later to adjust the wires.

The next step is critical. You need to measure and cut the wires as specified. The wire is lightweight aluminum alloy and it comes on two small spools. Be very careful when measuring and cutting—the wire likes to stay spooled up. If you let it slip, it will coil back with a good deal of force and this could cause an injury.

I cut and installed each wire separately. Once the wire is cut, you run it through the wire holders. The wires are fastened to a clear Plexiglas insulator. You adjust the wires by sliding the wire holders back and forth and you will want to adjust them so that there is a slight bow in the Fiberglas spreaders. The wires on mine seemed a little loose in this configuration, but I do have the slight bow in each element's spreaders.

There was only one unclear part in all the instructions. This involved the tuning stubs for the reflector element. There is a section that describes an eight-inch adjustable stub (step 4B) and then the next section gives exact measurements for the stubs for each of the five bands. The first part of this step is meant for those who will want to play with the front-to-back ratio versus gain. I chose to use the specified measurements and didn't figure I wanted to mess with this antenna, if in fact I ever got it all assembled. Using the preset reflector stub measurements is meant to give a good compromise between front-to-back ratio and gain.

I took my time building it. I assembled the spider parts one night, then built the reflector, then the driven element. All the parts were included and of top quality materials. The antenna is very lightweight when assembled.

The SWR and bandwidths are shown in the chart. All measurements exceeded the manufacturer's claims.

On the Air

I turned on the radio and worked VP5M in the Caicos Islands on 15 meters, then I8UDM and CT1GG/CU3, both on first calls through pile-ups. *[Editor's note: The author's QTH is in Tennessee.]* Next, I hooked up an antenna switch and went back and forth between my trusty vertical and the quad. The vertical would read 5-1 and the quad would read 5-7 to 5-9. In some cases I couldn't even hear the station on the vertical but it would be nice and strong on the quad.

WS4S, the only other QRPer in town, came over the same evening to help work on a friend's tube rig. He had to play with the new antenna before we started on the rig. The first thing he did was turn the power on the rig down to 1 watt and work 4X1EL, after which I worked him also. He turned the power down to 20 mW and worked Z36CXN in Macedonia. I really wanted the same station, so I cheated and cranked the power all the way up to 70 mW.

Next he turned the power to 50 mW and called CQ once. He said "this is futile." He called one more time and YO8CDC came back to him. He talked to this guy on 20 meters and turned the power down to 10 mW. The RST was 5-4-9.

Next he worked HA5HC in Hungary. He started with 50 mW and the RST was 5-7-9. He started chatting and turned the power down to 10 mW. The RST was now still 5-7-9 and Emil reported the signal was nice and strong. Next he turned the power to 1 mW and the RST was still a 5-5-9. Conrad WS4S talked with Emil HA5HC for quite some time on *very low power.*

73 Review

Number 8 on your Feedback card

by Steve Katz WB2WIK/6

Diamond Antenna Corporation
Distributed by RF Parts
435 So. Pacific St.
San Marcos CA 92069
Telephone: (619) 744-0900
Price Class: $174.95 suggested retail

The Diamond X2200A

A high-gain UHF/VHF omnidirectional base station antenna.

The Diamond Antenna Corporation of Tokyo has emerged as a premier amateur antenna manufacturer offering strong competition to the well-established American companies. They are already well-known for their "F," "U," and "X" model base-station VHF-UHF gain antennas. These models feature commercial performance at amateur prices and are easily recognizable by their gleaming white Fiberglas radiator casings and dual-band mobile whip antennas. Even their mobile whip antenna mounts are famous and rather innovative in design. I've been using a Diamond model F-23A for more than two years now as a repeater antenna on my 145 MHz repeater system. It's been working like a charm, creating excellent coverage with its low-angle radiation pattern and causing absolutely no receiver desensitization in full-duplex service at the 50 watt power level.

The X-2200A is a rather new product introduced for the American market just last year. It offers claimed omnidirectional gain of 6.0 dB on 146-148 MHz and 7.8 dB on 222-225 MHz, and because it covers the 1.25 cm band it has no domestic market in Japan (where 222 MHz is not an authorized amateur band).

This antenna employs a 3/4-wavelength center-loaded radiator on 2 meters and three 5/8-wavelength phased radiators on 1-1/4 meters, with the radiating elements made of brass and all the "works" enclosed in a beautiful Fiberglas "radome" (antenna cover). At the base (feed point) of the antenna, it has three quarter-wavelength drooping (down-sloped) radials to decouple it from its support and coaxial feedline. And, the X-2200A weighs in at a scant 2.64 lbs. The antenna is 11-1/2 feet tall fully assembled and is UPS-shippable because it comes broken down into two radiator sections plus the radial kit, base support tube and mounting hardware. Assembly requires only a Phillips screwdriver and takes about five minutes.

While the X-2200A is rated for "150 watts" maximum transmitter power, this is a very conservative rating. In fact, I have no clue why Diamond places such a low-power rating on the antenna, since its only active components are the brass rods which make up the radiator and some air-dielectric phasing/loading inductors which appear rugged enough to handle considerably more than the rated power. When I was testing the 2 meter omni model F-23A at home prior to installing it on a repeater, I transmitted with 1,000 watts of output power into this "200 watt" rated antenna for several minutes with no ill effects. Possibly the manufacturer is rating the X2200A based on the assumed use of a "duplexer" (RF signal-splitter) which most hams would use to separate the RF energy for the two service frequencies when using a single feedline to operate two bands. Diamond's "duplexer" for 146/222 MHz is rated at 150 watts, and this is more understandable. In any case, most hams operating VHF-FM would have little reason to exceed the 150 watt power level at the antenna feed point.

The X-2200A is an impressive package. It has a rugged look and, because the metal elements are entirely enclosed in Fiberglas tubing with a very weatherproof mid-section connector (used to join the upper and lower sections in the field), it should be extremely weather-resistant. The only exposed metals are aluminum, stainless steel and plated brass. Mounting hardware is all stainless steel (U-bolts, lockwashers and nuts) and should be completely impervious to the weather. I've had my F-23A installed at a hilltop repeater site for more than two years and the entire antenna is still "shiny." Viewing the mounting hardware through powerful binoculars, I can see it is all still "shiny," too.

Gain

Lacking an adequate calibrated reference antenna I could not measure the gain of the X-2200A. By computer analysis it seems that its gain on 146 MHz and 222 MHz are somewhat lower than Diamond's claims. But I should note here that most omnidirectional gain antennas for VHF/UHF seem to have published gain figures that aren't particularly accurate.

More important factors are radiation angle, bandwidth, good impedance matching, ease of assembly and installation, ruggedness and reliability, and overall cost effectiveness. In these areas, the Diamond products, including

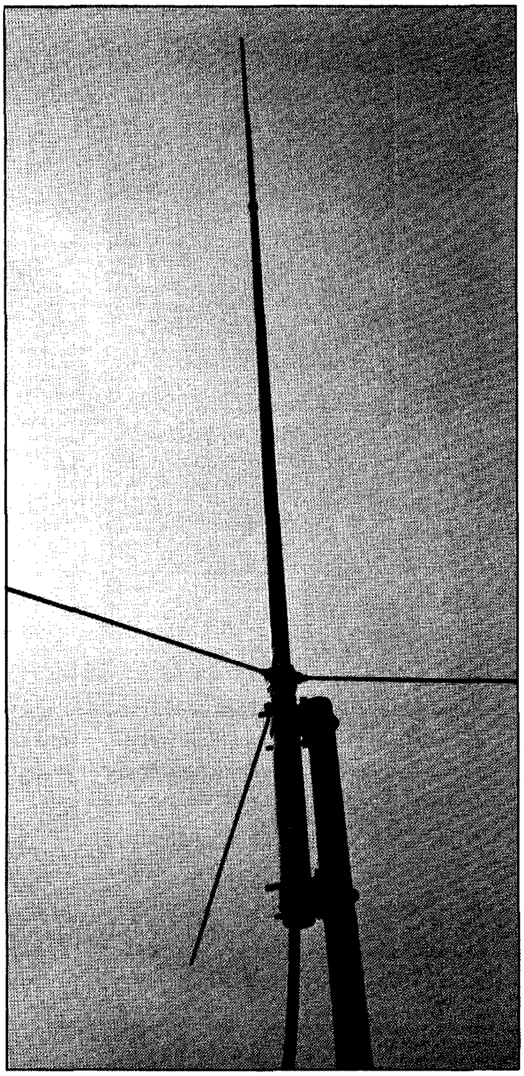


Photo A. The Diamond X2200A.

the X-2200A, definitely excel.

Since I couldn't measure gain, the only test I could run on the X-2200A was to compare it (on 2 meters) with my own personal reference antenna, an extremely popular all-aluminum stacked 5/8 wavelength radiator design with a tapped aluminum matching network at its base. It's a product that's been on the market for many years and still sells very well. The *claimed* gain (by its manufacturer) for my reference antenna is 6 dB and it is 10 feet tall, like the X-2200A. All things being equal, the Diamond X-2200A and my reference antenna should have worked about the same. Did they?

In a word, no. The dual-band X-2200A produced stronger signals (received and transmitted, in all directions and at various distances) than my reference antenna did. To make the comparison fair, I installed both antennas at the same height above ground (30 feet), and they were separated by 60 feet, which is nine wavelengths at 2 meters. Both antennas were fed by identical lengths of identical coaxial cable. At this writing, I still have both antennas installed and am still making comparisons. Because I live on a bit of a rise and am pretty high above average terrain for these parts, both antennas have a good "view" with a distant horizon ranging from 12 to 40 miles in most directions.

I am blocked in to the north by a mountain with an elevation of 3,600 feet, cresting only four miles from me, so I never expect great results from the north on VHF. But the other directions are more open, and I can always work into San Diego, some 120 miles to the southeast, with very low power on 2 meters. Working into Santa Barbara, some 65 miles to the west-northwest, is quite another story. In that direction, I have rugged coastal mountain terrain along the whole path and signals, while workable, are not terribly strong.

I took signal level data on various repeaters in all directions and recorded it on paper, using first my reference antenna and then the X-2200A. I took the data using S-unit signal levels on my FT-736R Yaesu VHF-UHF all-mode base station rig. S-meters being what they are, I don't believe the readings have any merit other than to compare one signal level to another. I then used my Hewlett Packard 608F signal generator, which has an output level accuracy of better than 1 dB at all levels and an output attenuator accuracy of better than 0.1 dB when comparing two levels that are less than 10 dB different, to determine what the different S-meter readings really meant.

Conclusion? The X-2200A outperformed my reference antenna by a peak of 3.1 dB, a minimum of 0.8 dB and an average of 1.95 dB. Pretty good for a dual-band antenna that has essentially the same aperture as the reference. I could not run the same set of tests on 222 MHz as I lacked an appropriate reference antenna. But the antenna does work well on 1.25 meters, and allows me to access the "CONDOR" 222 MHz linked repeater system very well through any of three "CONDOR" sites ranging from 20 to 70 miles away, using a Kenwood TH-315A handie-talkie (2.5 watts output). In all, I'm pretty impressed.

VSWR

The VSWR of the X-2200A is low, low, low. Since I'm using a 100-foot-long transmission line to reach the antenna and it has about 1.4 dB loss on 146 and 1.8 dB loss on 222 MHz, taking VSWR data in the shack would prove rather useless: The loss of the cable reduces the measured VSWR. So I measured VSWR across each band right at the antenna feed point with zero transmission line loss, and this data is shown in Table 1. I took the VSWR data with the antenna temporarily installed on a mast mounted in a small tripod sitting in my driveway, prior to installing the X-2200A on its permanent mounting. Raising the antenna another 20 feet or so higher shouldn't change the readings.

The X-2200A is supplied with mounting hardware that will accommodate mast diameters from 30 to 62 mm (about 1.2" to 2.4"), which should allow convenient installation by almost anyone. I like this much better than the mounting system on my reference antenna, which calls for plugging the base of the antenna into its mounting mast and only allows for a maximum mast diameter of about 1.3 inches. When mounting the X-2200A or any similar omnidirectional vertically-polarized antenna, be sure that the mounting mast does not protrude beyond the base of the antenna (where the radials attach) or performance will be severely degraded. This antenna should *not* be side-mounted on a tower unless it can be spaced at least 40" from the tower. Even with this spacing, the pattern will not be quite omnidirectional.

The Diamond X-2200A packs a lot of punch! It is another excellent product offered by a world-class manufacturer who is sensitive to the needs of American hams. 73

Table 1.
Measured VSWR vs. Operating Frequency, Diamond X-2200A

Frequency in MHz	VSWR
144	1.63:1
145	1.39:1
146	1.13:1
147	1.22:1
148	1.50:1
222	1.28:1
223	1.26:1
224	1.40:1
225	1.62:1

Notes: There are no field tuning adjustments for the X-2200A. It appears that this particular antenna was resonant towards the low-frequency end of the 1.25 meter band and could possibly be adjusted for lower VSWR at the upper end by slightly shortening the brass radiator length, but no attempt was made to do so. VSWR data taken with 12" feedline and directional coupler at the base of the antenna; measurements made in the shack at the end of a normal transmission line would indicate the VSWR to be lower.

Number 9 on your Feedback card

73 Review

by Larry Antonuk WB9RRT

Quickyagi Antenna Design Program

Designing a yagi has never been so easy!

RAI Enterprises
4508 North 48th Drive
Phoenix AZ 85031
Telephone: (602) 848-9755
Price Class: $39.95;
$19.95 for registered user upgrades;
$3 ($5 non-USA) S&H.

Put three hams in a room, and you'll wind up with four opinions on any given topic. While we share one of the most diverse hobbies on earth, it may be safe to say that one thing all hams have in common is antenna building. It's hard to find a ham who hasn't built at least one antenna—even if it's only a 10 meter dipole, or a 2 meter ground plane made from a coat hanger. The antenna is the interface between the rig and the ether, and an understanding of antennas (and antenna problems) is the common ground we all stand on. While virtually every ham has built some kind of antenna, it's also a safe bet that perhaps only one in 20 antenna builders has ever built a yagi.

How come? Several reasons come to mind. While it's pretty easy to figure the length of a 2 meter dipole, figuring out a 2 meter beam is a little trickier. Not only are you concerned with frequency and length, but you have to worry about the spacing between the elements. Which, of course, changes if you change the diameter of the rods. Which, of course, all changes if you want to add more elements. Which, of course, is not to mention trying to get your design to work best for a given front-to-back ratio. Or for a given bandwidth. Which, of course, means you might want to change the length a little and . . . Phew! This could be more complicated than it's worth.

Not only that, but if you do find a published design somewhere that includes more or less about what you want from your yagi, you still have to put it all together, which is a fair amount of work. Not that that's a problem, but it does represent a commitment of time and effort. If the design calls for 3/8" tubing, and you use the 1/4" stuff you have in the basement, will it still work? Is it worth the effort if you're not sure?

Once the thing is all screwed together and you want to test it . . . that's kind of tricky, too. Unless you're building scale models and have an anechoic chamber in the basement, it's pretty hard to get meaningful test results—especially on parameters like bandwidth and front-to-back ratios. You might even be able to do some A-B comparisons with your buddy across town, but who wants to build up two separate antennas just to try out a couple of new ideas?

Design, Quick and Easy

The answer to all of these problems lies in the ability to calculate your own yagi designs, based on the parameters you want, using the materials that you may have available. Yagi design was originally accomplished using the published NBS designs, which were put together using a combination of design and experimentation. Eventually software was developed that performed the calculations on an as-needed basis, but this was normally available only on a time-sharing basis on university mainframes. Once the desktop computer boom hit, it became viable for small companies to write the complex code needed to perform the thousands of calculations, and to offer it to the casual experimenter.

RAI Enterprises has taken this concept a step further. By writing the essential calculating routines in machine language, the Quickyagi program produces results in record time, while maintaining the user-friendliness of higher level languages. (For users new to antenna design software, the "BLAZING SPEED" referred to on the Quickyagi brochure means an antenna design in as little as a few minutes, up to a few hours. Obviously, this changes depending on whether you're using a Pentium or a PC JR, but in any case it beats the usual "enter the parameters, and go away for the weekend" software you may be used to.)

Perhaps the easiest way to get to know Quickyagi is to run the Auto Design feature, which creates the yagi design with a minimum of information. Starting the Auto Design mode is accomplished with two keystrokes after the opening menu. The user is then prompted for the design frequency, the number of elements desired, and the diameter of the available elements. After a few seconds, the program returns with the antenna gain, front-to-back ratio, length, and input impedance. The user is then prompted to choose between maximizing the front-to-back ratio, or maximizing the gain for a given front-to-back ratio. If the second option is chosen, the user may pick from several more options—best gain while choosing the front-to-back ratio, optimum gain, or optimum bandwidth. Once all of the selections are made, the program goes into the "thinking" mode. This

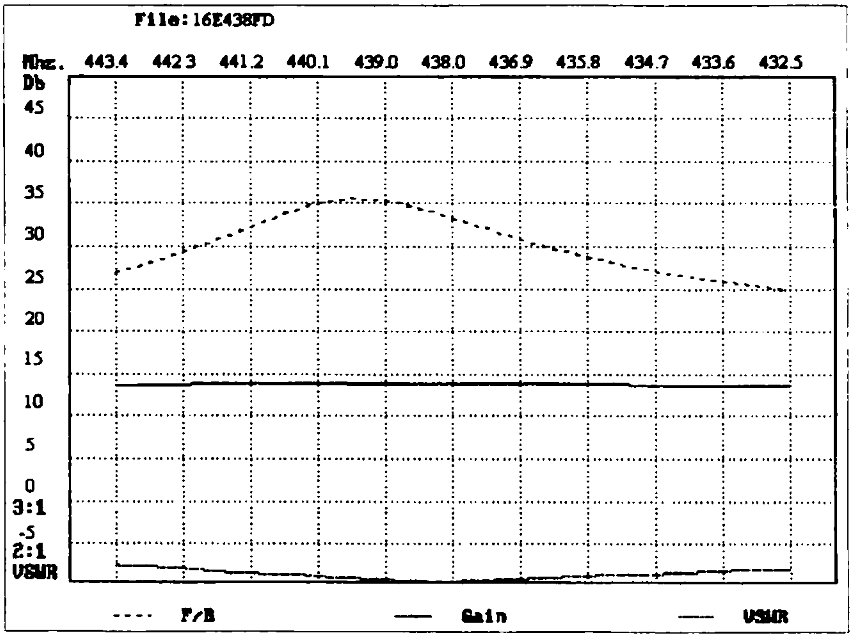


Figure 1. Performance vs. bandwidth graph.

can take several minutes to several hours, depending on the machine and the antenna design being performed. (Again, due to various machine configurations, time comparisons may be somewhat meaningless. However, a six-element 146 MHz yagi took about 15 minutes to optimize on a '286 clone. *[Manufacturer's Note: The '286 clone was running without a math coprocessor. The results will be up to four times faster with a coprocessor.]*)

Once the design is optimized, it may be evaluated in several ways. Quickyagi will draw a full-screen polar plot of the antenna gain, in either an elevation or azimuth mode. Linear or logarithmic scales are available in either case. These plots can be viewed on-screen, or sent to the printer for later examination. A Bandwidth Chart Utility displays the bandwidth information (gain, F:B, impedance, and VSWR at 21 frequencies) in chart or x-y graph mode. Again, these can be printed in hard copy and saved. Antenna designs can be saved to disk, and pulled up later for further design and testing.

In addition to the Auto Design mode, the program also supports manual entry of various parameters, and will calculate the missing features. For instance, you might need to design a yagi to make use of that bundle of 5/16" aluminum you dragged home. You might have a 10-foot section of square tubing that would make a nice boom. What is the best arrangement of elements to give you maximum gain on 440 MHz? Quickyagi can let you know. A Scaler routine allows scaling an existing design to a new frequency, by changing either the element lengths, or the lengths and the spacing. (Remember that high-class five-element yagi you bought at the last hamfest? The one that turned out to be on 155.000 MHz? These last two features are just the ticket to tell you if you can just lengthen the elements, or if you have to move them . . . or if you threw 25 bucks down the drain!) Options are available that calculate element lengths using tapered elements, for the use of telescoping tubing, plus element compensations for the boom, the ability to view the antenna's geometry, and the ability to easily model a folded dipole driven element. In case you only associate yagis with VHF and above, note that Quickyagi can calculate designs from 1.5 to 999 MHz, with up to 17 elements. (Please check your local zoning regulations before building that 160 meter, 17-element beam.) Even if you don't plan on building any HF beams, Quickyagi will gladly calculate wire beam dimensions for use on Field Day, or during emergency operations. The best part is that Quickyagi doesn't assume anything—just tell it about your resources and it will design a yagi that will work for you.

The Quickyagi program comes with "on-disk" documentation, which means you won't get a fancy hard-cover manual. The manual will, however, be up-to-date, which is somewhat of a rarity these days. In any case, the manual amounts to a half dozen pages, due to the ease-of-use of the program itself.

The Quickyagi program qualifies as a low-priced piece of software, but could just be your key to a new realm of antenna building. By removing the mystery from yagi design, it allows antenna experimenters to get involved with "from scratch" designs using materials they already have on hand. "What if" comparisons can be performed by modeling existing yagis, with the idea of performing modifications, or just for the fun of it. Existing antennas can be modified for different frequency ranges, which open up a great source of antenna materials—the surplus commercial market. If you build even one yagi a year, you'll find Quickyagi to be well worth the money.

(Quickyagi runs on any XT or better with at least 640K of RAM, using CGA, EGA, VGA, or Hercules graphics. A math coprocessor is supported but not required.)

[Manufacturer's Note: The program is now optimized to run on an AT or later models of the "Turbo" XT running the NEC V-20 microprocessor. A math-coprocessor-only version is available by special order, at no extra charge, for the older 8088 PC/XT.]

A Sensitive Bandspread SWL Receiver

Aaah, the nostalgiac smell of dust burning off tubes!

by Eric R. Johnson XE2/KB6EPO

Back in the 1920s and during the Great Depression era, the home-brew regenerative shortwave receiver was all the rage. Radio was coming of age and everyone wanted to listen in. Money was tight and although most commercially made radios were of the regenerative type, they were still too expensive for the average consumer. Yet the low parts count of the regenerative receiver made construction a snap and kept costs down, keeping this type of receiver popular with the home-brewer right up to the 1960s. And the regen's sensitivity was hard to match by all but the best superheterodyne receivers of the time. These attributes still hold true today!

This little radio can "hear" everything on the SWL bands that my Yeasu FT-747 can! An 8-foot piece of wire strung out along the test bench or behind the desk is more than enough to pick up all the major broadcasters. Of course, the more antenna the merrier—but the point is that excellent reception is possible with an indoor antenna right at your listening position. The three-stage circuit is typical of a "deluxe" setup of the era. The physical size is less than half of what someone in those days might have constructed using the same schematic, thanks to the substitution of "modern" miniature tubes and components.

I have departed from our theme era in the design of the power supply in order to make the receiver completely portable. In the old days they used bulky, non-rechargeable "A" and "B" batteries to provide filament and plate voltages. The super deluxe setup sported a line-operated transformer and vacuum rectifier "B battery eliminator," the use of which often required the owner to replace all the existing "DC filament" tubes in the radio with "modern AC filament" tubes. Portabili-

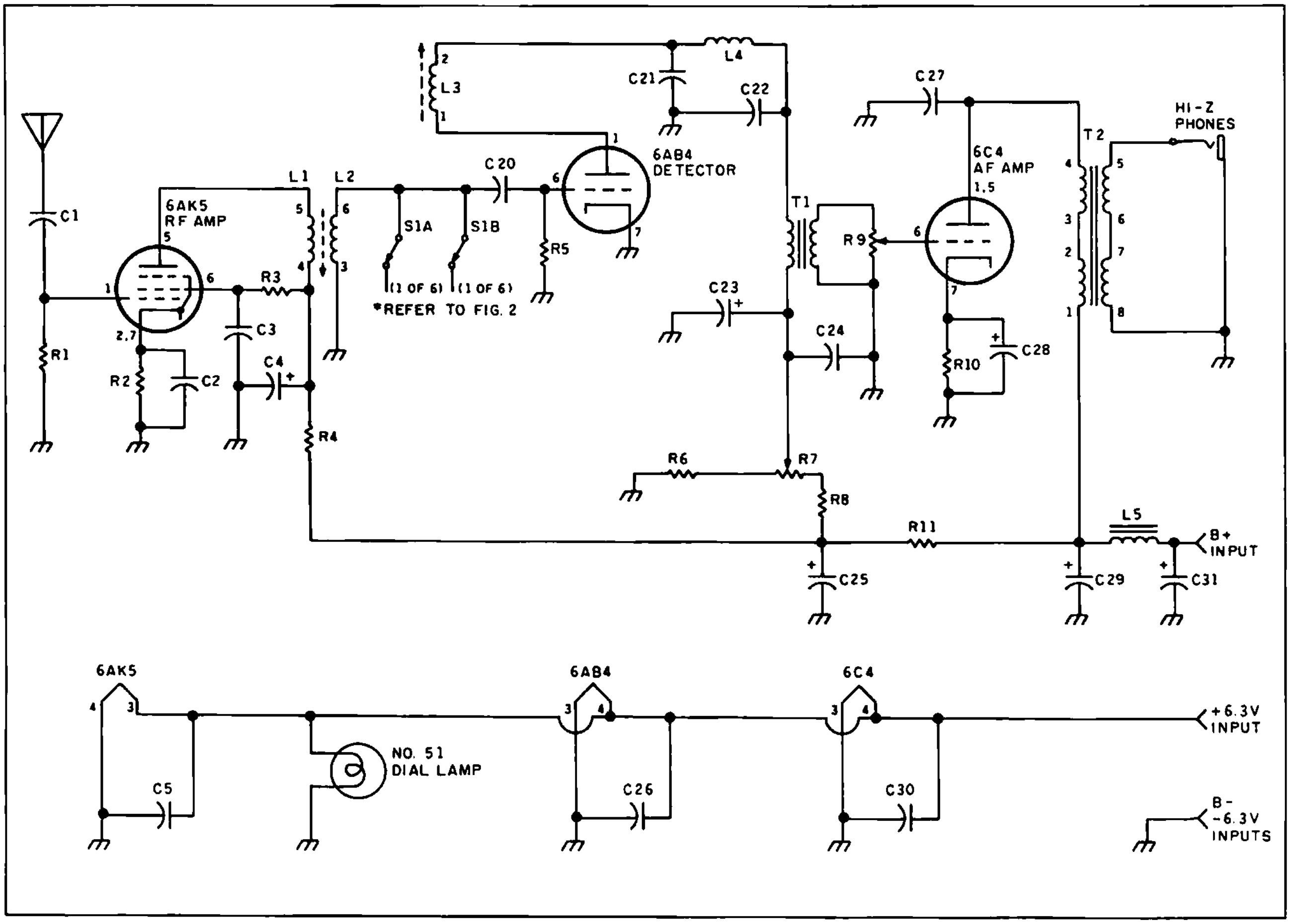


Figure 1. Receiver schematic diagram.

ly was either tedious or impossible. My power supply allows portable operation for about 10 hours from a single 6 volt, 10 amp-hour rechargeable sealed lead-acid battery (gel cell). When connected to the AC line it both operates the radio and charges the battery.

Receiver Theory of Operation

The receiver (Figure 1) consists of an untuned pentode radio frequency amplifier, a triode regenerative detector, and a power triode audio frequency amplifier. Output is into a pair of high impedance headphones, either 2k ohm magnetic types or the crystal type. Both are readily available on the surplus market. Those "extra" resistors and capacitors you see sprinkled liberally throughout the schematic are for bypassing and B+ line decoupling filters. They should not be left out of the circuit as a way to save money! These parts are what make the difference between a "sweet" stable and predictable regenerative receiver and a wild untameable howling "beast" of a receiver.

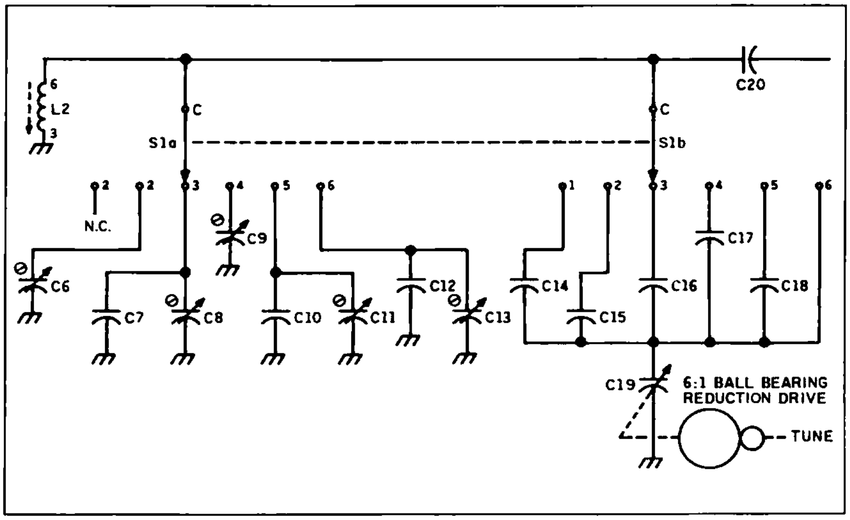


Figure 2. Tuning components schematic detail.

The RF Amplifier

The 6AK5 is a sharp-cutoff pentode designed for use in RF or IF amplifiers in high-frequency wideband applications at frequencies up to 400 MHz. Its primary purpose is to isolate the antenna from the tuned circuit in the detector's grid. This eliminates the detuning problem found in regen sets where the antenna is coupled directly to the detector. In spite of this being an untuned amplifier, and thanks to the use of the pentode, we still get about 6 dB of gain on all the bands. C1 couples the antenna to the control grid. L1 couples the amplified output to the detector.

The Regenerative Detector

The 6AB4 is a high-mu triode designed for use in cathode-drive amplifiers, frequency converters, and oscillators at frequencies up to 300 MHz. Electrically identical to one section of dual-triode type 12AT7, here it is used as a regenerative detector. L2 and the capacitors selected by S1 form the only

tuned circuit in the radio. C20 couples the selected signal to the control grid and, along with R5, forms a grid-leak bias circuit. The amplified RF signal is coupled by L3, in phase, back to the tuned circuit L2/S1. This causes two effects: The signal is re-amplified, thus giving extreme sensitivity, and it introduces "negative resistance" into L2, which dramatically increases it's "Q." This allows our single tuned circuit to give our radio a selectivity on the order of 3 kHz. C21 is the return path for the RF signal. The same signal is detected by grid-leak action and the amplified audio is developed across the primary of T1. L4 and C22 filter any residual RF from the detected audio. Of course, all this must be controlled somehow or else we'd have an RF oscillator instead of a detector! R6, R7, and R8 form a voltage divider to provide variable B+ voltage to the detector. C24 filters out any noise generated by the mechanical motion of R7. In use, R7 is advanced until the tube oscillates (which can be heard in the headset), and then backed down until oscillation just stops. The circuit is now set up for best sensitivity and selectivity for AM signals.

The Tuning System

Now refer to Figure 2. L2 and the capacitors selected by S1a and S1b form the tuned circuit in our radio. Six shortwave bands are

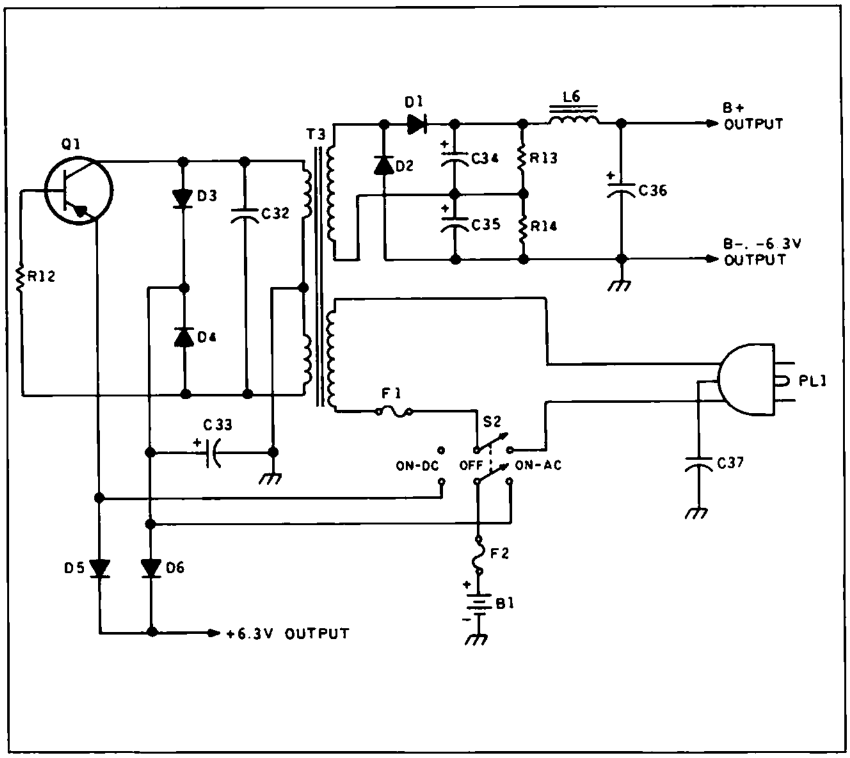
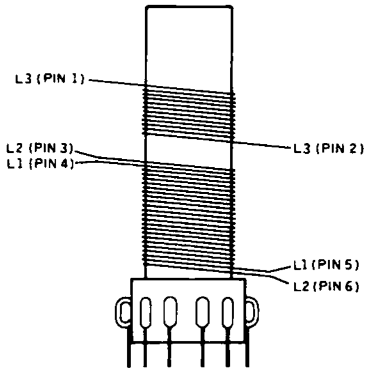


Figure 3. Power supply schematic diagram.



L1 - 14 TURNS, CLOSEWOUND BETWEEN L2 TURNS.
L2 - 15 TURNS, SPACED BY L1.
L3 - 12 TURNS, CLOSEWOUND, WINDING SPACED 1/8" FROM TOP OF L1/2.

* USE NO.26 ENAMELLED WIRE FOR ALL 3 INDUCTORS.

** CORE IS 1/4" DIA. BY 1 1/8" LONG PHENOLIC, WITH 2 FERRITE SLUGS. CORE BASE SECTION IS 1/2" DIA. BY 3/8" LONG, WITH 6 SOLDER LUGS IMBEDDED.

Figure 4. Coil winding diagram.

selected by S1 as follows:

Position 1 = 13 Meter Band. 21.200 - 22.000 MHz
Position 2 = 16 Meter Band. 17.400 - 17.980 MHz
Position 3 = 19 Meter Band. 15.000 - 15.580 MHz
Position 4 = 21 Meter Band. 13.400 - 13.900 MHz
Position 5 = 25 Meter Band. 11.600 - 12.075 MHz
Position 6 = 31 Meter Band. 9.450 - 9.900 MHz

S1a performs the function of "bandset." Capacitors C6 through C13 are either fixed silvered mica or miniature silvered ceramic trimmer capacitors. S1b selects various capacitors to be placed in series with bandspread/main tuning capacitor C19. C14 through C18 are fixed silvered mica types. C19 is a 25 pF air-dielectric variable capacitor with a standard 1/4-inch shaft. Between it and the tuning knob is a 6:1 ball bearing reduction drive to which is attached a 4-inch diameter aluminum plate that serves as the tuning dial.

In a tuned circuit with a fixed inductance, a variable capacitor will have a greater effect on tuned frequency the higher the frequency. S1b introduces ever smaller fixed capacitors in series with C19, effectively reducing its overall change in capacitance each time the bandswitch is moved to a higher band. This ensures that the entire 180 degrees of rotation on the tuning capacitor is used to tune each band, keeping the stations from being bunched up in a small area on the dial. With this system the 6:1 reduction drive is not really necessary, but I had a few laying around so I used one anyway.

The AF Amplifier

The 6C4 is a medium-mu power triode designed for use in Class C RF amplifiers. It is capable of 5.5 watts of output at frequencies in the 50 MHz range. It is used here because of its low plate and filament current requirements compared to a power pentode. This is important since we want to be able to operate the radio on battery power for long periods of time. The audio output is louder than I can stand with the volume control advanced halfway on most signals. T1 is a step-up audio transformer with a ratio of 1:2.5. R9 is the volume control. T2 matches the output impedance of the 6C4 to the headphones.

Power Supply Theory of Operation

The heart of the power supply (Figure 3) is transformer T3. And the good news is that it's nothing special! It has two 6.3 volt 2 amp secondaries, and two 115 volt primaries. A 12.6 volt transformer with two primaries would work just as well. For both AC and battery operation, we use one of the primaries to provide the B+. D1, D2, C34, and C35 form a full-wave voltage doubler. L6 and C36 smooth the rectified output.

During AC operation, one half of DPDT toggle switch S2 routes the line voltage to the other primary of T3 via F1. C37 connects the line ground to the circuit ground. The two 6.3 volt secondaries, D3, D4, and C33, form a full-wave power supply that produces 6.3 volts DC at 4 amps (under load). D6 routes this voltage to the filaments and the dial lamp, which use up 0.55 amps of the available current. The other half of S2 routes this voltage to B1 via F2, making available up to 3.45 amps to charge the battery. There is no danger of overcharging the battery because the voltage is within the acceptable range for continuous "float" charging. D5 ensures that Q1 and R12 have no effect on operation, effectively disconnecting them.

During DC operation, current from the battery is routed through F2, one half of S2, and D5 to provide power for the filaments and dial lamp. At the same time, current from the battery is used to operate the power oscillator consisting of Q1, R12, and both secondaries of T3. C32 shapes the waveform so that it is closer to being a sine wave than a square wave, thus eliminating the switching transients present in a square wave which are difficult to filter out. The 115 volt AC current generated in the unused primary of T3 is isolated from PL1 by S2, thereby eliminating a shock hazard there. Because of the way they are connected, D3, D4, C33, and D6 are effectively "not there" during DC operation.

Construction Hints

The heart of the receiver is the L1-3 coil assembly. You'll have to wind it yourself. Figure 4 shows how it's done. The coil form was found at a surplus store, and the winding that was on it had to be removed first. As previously mentioned, the output of the 6AB4 must be fed back in phase to its grid in order for it to oscillate. If the coil is wound and connected as shown, feedback will be in phase. A handy rule of thumb to keep in mind goes as follows: If L2 and L3 are wound end-to-end in the same direction, the plate connection is to the outside of the plate or "tickler" coil (L3) when the grid connection is to the outside of L2. If you lose track of the leads and the detector fails to oscillate after being wired, swapping the two leads of L3 will fix the problem. The other consideration is to make sure that when laying out your parts-mounting plan, the coil assembly is separated by at least one coil diameter from any large metal objects (such as the front panel or an audio transformer). This prevents any such object from ruining the high "Q" of the coil.

If you can't find any audio transformers for T1 and T2, you can substitute resistors and capacitors without losing too much audio gain. To substitute for T1, replace the primary with a 250k ohm resistor and connect a 0.01 uF capacitor from the junction of that resistor and C22 to the top of volume control R9. To substitute for T2, replace the primary with a 47k ohm resistor and connect a 0.1 µF capacitor from the plate of the 6C4 to the headphone jack. If T2 is replaced by R/C coupling then C27 may be omitted also.

L5 and L6 are not critical. Anything from 2 henries on up should work fine. If you don't have an inductance meter, just use an ohmmeter to find one that measures between 150 and 700 ohms. The current through these is only 18 mA, so anything small in size that fits either of the above specifications will work. It can be a choke or the primary of an old tube-type audio output transformer. I used the latter for mine. They measured 4.5 henries on the inductance meter, and 150 ohms on the ohmmeter.

A regenerative detector occasionally shows a tendency to change frequency slightly as the hand is moved near the dial. This condition (body capacity) can be corrected by better shielding. I used double-sided PC board material for the front panel and receiver sub-chassis. The front panel is 10-1/2 inches wide by 6-1/2 inches high. The receiver sub-chassis is 9 inches wide by 4-1/2 inches deep, and is soldered at a right angle to the center of one side of the front panel. This results in a "T"-shaped assembly that is very strong. Once all the controls are mounted on the front panel their metal mounting bushings make contact with the copper on both sides of the panel, thereby providing double shielding. With this technique there is no body capacity and the receiver is completely stable. The tube sockets and all the other parts are mounted on the sub-chassis after appropriate sized holes are made. Wiring is done point-to-point, with the advantage that wherever a ground is required it can be soldered to the sub-chassis with minimal lead length.

You could develop your own PC artwork for the receiver sub-chassis and etch it before soldering to the front panel if you like. When making your layout for the receiver, the important thing to consider is to keep all leads and/or PC runs as short as possible between the plate of the 6AK5, L1/2/3, S1 and its associated capacitors, and the 6AB4. Any layout you can come up with that accomplishes this goal will work fine.

The power supply was also built on a piece of PC board material measuring 7-1/2 inches long by 3-1/2 inches wide. You could etch a pattern for this if you like, but it's not necessary. The power switch is a three-position "ON-OFF-ON" type, and is mounted on the front panel. Q1 is mounted on a small heat sink just slightly larger than the area of the transistor body and about 1 inch tall. The transistor runs cool to the touch even after hours of operation. R12 will probably need to be experimented with if you use a different transistor or transformer. You'll find the right value will be somewhere between 100 ohms and 1k ohm.

I built a box out of standard 1-inch appearance pine, like you would use to make shelves out of, and finished it with polyurethane varnish. The battery and power supply mount inside it towards the rear, and the receiver/front panel assembly slides in the opening on the front and is secured by several wood screws with wide decorative heads. A short cable with a plug on it connects the power supply to a socket on the receiver. The line cord and antenna jack are on the back of the wood box, and the antenna jack connects to the receiver through a short coaxial cable and RCA plug. Four rubber feet screwed into the bottom of the box finish it off, and the end product looks real "olde-tyme."

Table 1 lists all the parts, additional substitution information where allowable, and sources of parts for those who do not have any decent stores nearby.

Calibration and Operation

All calibration is done with the aid of a signal generator. It is not necessary to make a direct connection between the receiver and the signal generator. A short piece of wire connected to the output of the signal generator will radiate enough signal to be picked up by the windings of L2. Set the top (L3) slug in the coil form so that it's flush with the top of the form, then calibrate in the following order.

1. Band 1 (13 M). Set the tuning capacitor, C19, to its fully unmeshed position. Set the signal generator for 22.000 MHz. Adjust the bottom (L2) slug in the coil form until you can hear the signal best.
2. Band 2 (16 M). Leave C19 set as it is. Signal generator to 17.980 MHz. Adjust C6 for best signal.
3. Band 3 (19 M). Adjust C19 to the fully meshed position, then open it up just a tad. Signal generator to 15.000 MHz. Adjust C8 for the best signal.
4. Band 4 (21 M). Return C19 to the fully unmeshed position. Signal generator to 13.900 MHz. Adjust C9 for best signal.
5. Band 5 (25 M). Leave C19 set as it is. Signal generator to 12.075 MHz. Adjust C11 for the best signal.
6. Band 6 (31 M). Adjust C19 to the fully-meshed position. Signal generator to 9.450 MHz. Adjust C13 for the best signal. Now that the band edges have been defined, you can go back and and mark whatever calibration intervals you wish for each band on your tuning dial. I painted my dial white, then used black dry transfer numbers for this.

To listen to stations, connect an antenna and select a band with S1. Set the volume control at mid-range, then adjust the regeneration control (R7) until the detector breaks into a "hiss," which indicates oscillation. Slowly reduce the regeneration control until the "hiss" just stops. You should now be able to hear stations as the tuning control is rotated. Sometimes the setting of the regeneration control needs to be changed to maintain the "sweet spot" from one end of the tuning dial to the other within the same band. If you are hearing beat notes as you tune across stations, the regeneration control is advanced slightly too far for best AM reception. This is a good way to find stations, but once you've got one tuned in to "zero beat," reduce the regeneration control a tad

and you'll be in the "sweet spot" where sensitivity, selectivity, and fidelity of detected audio are all at their best.

The detector will require more voltage from the regeneration control (R7) in order to oscillate on the 31 meter band, and less voltage to oscillate on the higher bands. If it will not oscillate sufficiently on the 31 meter band, you can either turn the top (L3) slug in the coil form in until oscillation is enough, or play with the values of R6 and R8. When everything is set up right, the regenetation control will be one-quarter of its rotation from the ground end for reception on the 13 meter band, three-quarters of it's rotation from the ground end for reception on the 31 meter band, and somewhere in the middle for all the other bands. My receiver needs 16 volts from R7 to work on the 13 meter band and 60 volts to work on the 31 meter band.

To recieve signals below the 31 meter band, you will need to make your L1/2/3 coil larger (more inductance), and experiment on your own with the values of the capacitors selected by S1. You'll also want to use a larger capacitor for C19, say 50 pF, in order to get sufficient bandspread on the lower frequencies. With the coil specified in Figure 4, you cannot receive well below the 31 meter band. This is because the regenerative receiver likes to have a high "L" to "C" ratio in its tuned circuit. Adding more capacitance to make the specified coil tune below the 31 meter band ruins the high "L" to "C" ratio, resulting in a receiver that needs excessive voltage from R7 in order to oscillate and ruining the high selectivity of the circuit.

If you decide to calibrate the receiver for the ham bands instead of the broadcast bands, you'll find that CW is easy to copy. To receive CW, the regeneration control is set so that the detector is just starting to oscillate. This provides "autodyne" reception. The code signals can be tuned in and will give a beat note with each signal depending on the setting of the tuning control. As the receiver is tuned through a signal, the tone first will be heard as a very high pitch, then will go down through "zero beat" and rise up again on the other side, finally disappearing at a very high pitch. The same setting of the regeneration control used for CW reception will also allow SSB to be copied. Tuning will be very critical, but is easy to do with the help of the 6:1 ball reduction drive.

Whatever bands you calibrate your receiver for, a few moments practicing tuning-in stations will get you familiar with the way a regenerative receiver operates and soon you'll be an old pro at it. I guarantee that if you've never played with one of these sets before, the more you listen around the bands the more you'll be amazed at what a small handfull of parts in a simple circuit can do. And just maybe you'll get to feel a little of what it meant to be a "real ham" in the "old days" when "everyone built their own rigs" from whatever they could find laying around! ■

See Parts List on page 38

Continued from page 37

Parts List

Part	Description	Source (see key below)	Substitution Range
B1	6 volt, 10 Ah gel cell	2	Larger current capacity
C1	56 pF, 500V ceramic disk	1,2	33-100 pF
C2	0.02 µF, 25V ceramic disk	1,2	0.01-0.1 µF
C3,24	0.02 µF, 500V ceramic disk	1,2	0.01-0.1 µF
C4,25,31	10 µF, 400V electrolytic	1,2	10-100 µF
C5,26,30	0.15 µF, 50V ceramic disk	1,2	0.01-1 µF
C6,8	6-25 pF ceramic trimmer	2	None*
C7,14	15 pF, 500V silver mica	1,2	Ceramic NPO type*
C9,11,13	10-40 pF ceramic trimmer	2	None*
C10,16	30 pF, 500V silver mica	1,2	Ceramic NPO type*
C12	68 pF, 500V silver mica	1,2	Ceramic NPO type*
C15	20 pF, 500V silver mica	1,2	Ceramic NPO type*
C17	39 pF, 500V silver mica	1,2	Ceramic NPO type*
C18	62 pF, 500V silver mica	1,2	Ceramic NPO type*
C19	25 pF air variable	1,2,3	None*
C20	100 pF, 500V silver mica	1,2	47-220 pF
C21	270 pF, 500V silver mica	1,2	220-390 pF
C22	2500 pF, 500V silver mica	1,2	680 pF-3300 pF
C23	2.2 µF, 250V electrolytic	1,2	1-5 µF
C27	0.0015 µF, 500V ceramic disk	1,2	750 pF-0.0022 µF
C28	100 µF, 50V electrolytic	1,2	10-150 µF
C29,34,35	100 µF, 400V electrolytic	1,2,3	50-220 µF
C32	2 µF, 150V non-polarized	2,3	0.5-4 µF non-polarized
C33	1000 µF, 16V	1,2	470-5,000 µF
C37	0.1 µF, 400V	1,2	0.047-0.68 µF
D1,2	600 PIV, 1A RS#276-1104	5	Any equivalent
D3,4,5,6	50 PIV, 3A RS#276-1141	5	Any equivalent
F1	FO250V 3/8A	1,3	None
F2	FO250V 4AS	1,3	None
L1,2,3	Handwound on 1/4" form	1,2	None* (see Figure 4)
L4	4 µH RF choke	1,2,3	2.5-10 µH
L5,6	5H; 150 ohms DC choke	1,2,3	See text
PL1	3-wire line cord set	1,2	
Q1	MJ2955	5	RS#276-2043
R1	560k ohm, 1/2W	1,2	100k-1 MEG
R2	330 ohm, 1/2W	1,2	100-560 ohm
R3	22k ohm, 1/2W	1,2	18k-27k
R4	4.3k ohm, 1/2W	1,2	2.2k-5.6k
R5	3.3 megohm, 1/2W	1,2	1 MEG-4.7 MEG
R6	10k ohm, 1/2W	1,2	1k-10k
R7	50k ohm, 1/2W pot.	1,2,3	100k pot.
R8	27k ohm, 1/2W	1,2	10k-33k
R9	250k ohm, 1/2W pot.	1,2,3	100k-500k pot.
R10	2.4k ohm, 1/2W	1,2	1.8k-3.3k
R11	1k ohm, 1/2W	1,2	1k-4.7k
R12	560 ohm, 1/2W	1,2	See text
R13,14	470k ohm, 1W	1,2	220k-1 MEG, 1W
S1	2-pole, 6-Position rotary	2,3,4	
S2	DPDT "ON-OFF-ON" toggle	2,3,4	
T1	Audio transformer, UTC #TF5SX21ZZ, 1:2.5 ratio pri = 1k ohm DC, sec = 6.5k ohm DC	1,2,3	See text
T2	Audio transformer, UTC #TF4RX13YY, pri Z = 10k, 790 ohm DC sec Z = 2k, 195 ohm DC	1,2,3	See text
T3	STANCOR #P-6376 dual 115V primaries dual 6.3V, 2A secondaries	2,3	See text
V1	6AK5 sharp cut-off pentode	1,3	6AJ5,5595,5654,EF95
V2	6AB4 hi-mu triode	1,3	6664,EC92
V3	6C4 power triode	1,3	5610,6100,6135,EC90
Miscellaneous:			
(3 ea.)	7-pin miniature socket	1,2,4	
(1 ea.)	6:1 ball bearing drive	2,4	**
(1 ea.)	Bayonet lamp socket	1,2	**
(1 ea.)	#51 miniature lamp	1,2	**
(1 ea.)	Hi-Z headphones military styles H-43B/U, H-23B/R, HS-16, or equiv.	1,2,3	See text

Substitution Notes Key:

none = Do not substitute or omit for safety reasons.
none* = Values may be changed to tune different bands.
Values may need to be varied slightly to tune specified bands due to differences in stray wiring capacitances between your model and the prototype.
** = May be omitted if desired.

Source Key:

1.) Antique Electronic Supply, 6221 S. Maple Ave., Tempe AZ 85283
(602) 820-5411; Fax: (602) 820-4643

2.) Gateway Electronics, Inc., 8123 Page Blvd., St. Louis MO 63130
(314) 427-6116
9222 Chesapeake Dr., San Diego CA 92123
(619) 279-6802

3.) Fair Radio Sales, P.O. Box 1106, 1106 E. Eureka St., Lima OH 45802
(419) 223-2196/227-6573; Fax: (419) 227-1313

4.) Surplus Sales of Nebraska, 1502 Jones St., Omaha NE 68102
(402) 346-4750; Fax: (402) 346-2939

5.) Radio Shack

A 2 Meter Half-Kilowatt for $1 per Watt

Build this VHF amp using vacuum-tube technology!

by Steve Katz WB2WIK/6

Everybody wants a stronger signal, and those operating 2 meters are no exception. In the car, it is economically feasible to run 170 watts RF output power or so on the 144 MHz band before the law of diminishing returns sets in. Solid-state "brick" amplifiers, which are powered by 13.8 volts DC, abound. These little amplifiers cost about $2 to $2.50 per watt new, and often include a built-in receiver preamp.

For the home station, tube-type amps are much more efficient than solid-state amps. Example: Let's say you intend to use a 170-watt-output "brick" amplifier at home, and its RF drive (input level) requirement is 30 watts to achieve full output. The amplifier requires a regulated source of 13.8 VDC, and draws 27 amperes at full power. To generate this 373 watts of DC power, you use a commercially-manufactured linear power supply that, to deliver 13.8V at 27A, requires an input of 117 VAC at 5 amperes. So, to run a measly 170 watts RF output power you are consuming 585 VA (volt-amperes, the AC equivalent of watts) every time you "push the pickle." To generate that 30 watts RF drive into the amplifier you are probably consuming at least 100 VA more. So, to run 170 watts RF output, you are consuming 685 VA of AC power, which is an overall efficiency level of about *25%*.

The solid-state "brick" amplifier is a convenience which requires no tuning across the band, but its efficiency isn't very good, and gets *much worse* at lower power levels. If you want to run higher power, the overall cost of doing so will skyrocket into the $3+ per watt range as the regulated DC power supply requirements become unwieldly. I can understand using solid-state amps for the car, truck, boat, or RV, since the normal power is 13.8 VDC. But at home, when you use an outboard solid-state amp, you are first down-converting power from 117V (or 234V) AC to 13.8 VDC, then up-converting that to useful RF energy.

While modern "switch-mode" regulated power supplies are 90% efficient, most hams aren't using these because of their cost. Instead, they're using old-fashioned "series regulator" linear power supplies, which are terribly inefficient, wasting a lot of power as heat. Not only that, but the "no-tune" solid-state amps can only be optimized at *one* power level (typically the highest power they can run) and lose efficiency quickly as the power level is reduced. The no-tune solid-state amps will not allow you to transmit into a mismatched load, should you ever need to, because they all have VSWR protection circuits in them that shut down if the SWR gets high. Most also include a thermal overload protection circuit which shuts them off if they get too hot—and they *do* get mighty hot, especially under high duty-cycle service. Yuck! What's a ham to do?

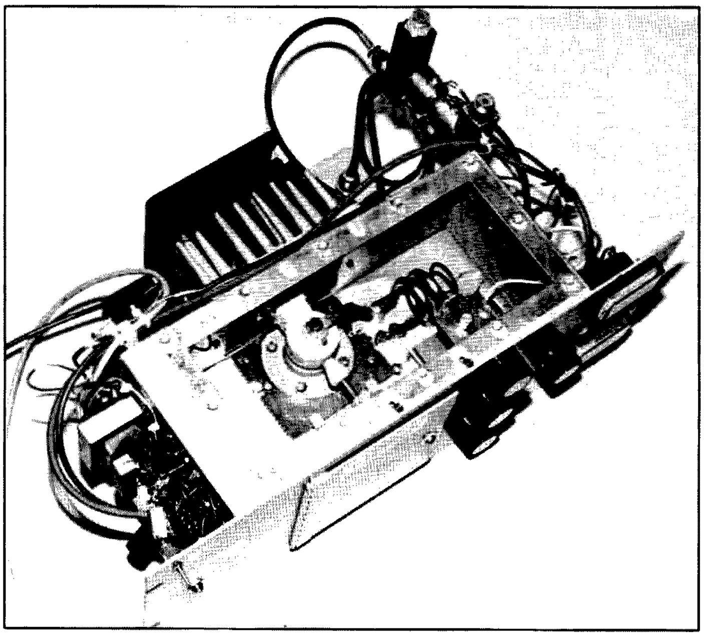


Photo A. Top view of the RF deck. The 8560A external anode tetrode is visible at center, with the plate tank circuit to the right.

Tube Amplifiers

How about taking a giant step backwards in technology and using a tube amplifier instead? Tubes are still heavily used in modern high-powered transmitters and amplifiers, and for good reason: They tend to develop more gain and operate at higher efficiency levels, especially at higher radio frequencies, than transistors do. Not only that, but reasonably-priced tubes are available that will operate at a linear 1 kilowatt output (per tube) without the need for complicated combining networks and extremely high-current regulated DC power supplies. (To run 1 kW output power at 50% stage efficiency using 28 VDC transistors requires a 71.4 amp power supply, the cost of which could exceed that of the rest of the amplifier.) Sure, tube amps usually require tuning, but in the shack, where the operator has access to a wattmeter and tuning controls, this is not a serious drawback.

How efficient can we make a 2 meter tube amplifier? *Very* efficient. We can use a tube circuit that is about 65% efficient running class AB_2, and a power supply that is 90% efficient. Under these conditions, that 400 watt amp would consume a mere 684 VA of AC power, an overall efficiency level of *58.5%* (compare this to the 25% solid-state scenario described earlier). This will generate far less heat, and result in a much lower electric bill for the operator. Can this be practical? Surely.

There are two more neat

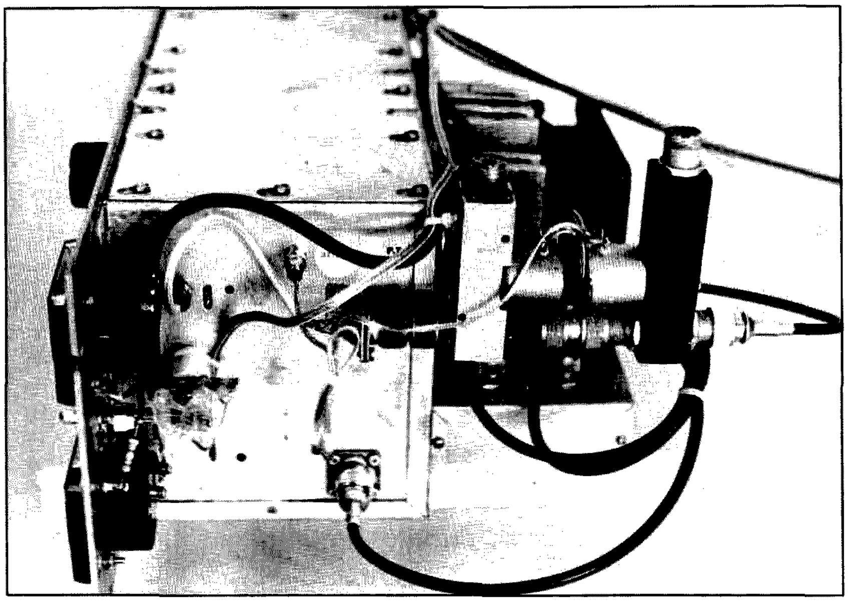


Photo B. Side view of the RF deck. Note the two panel meters, RF IN and RF OUT jacks, meter wiring, and Dow-Key RF relays.

things about tubes. If operated in driven-grid configuration, many power tetrodes will develop about 20 dB gain. Additionally, tubes don't mind heat; in fact, they need it to work. While transistors must be *derated* for operation at high temperatures, and will fail if operated too hot, tubes don't require such derating and most power tubes are intended to be operated at seal temperatures exceeding 200 degrees C, where no normal transistor will survive. Ever see the output power of your solid-state amp start to fall off as it gets hot? This won't happen with tubes.

Finding an Amplifier

We could start "from scratch" and build an amplifier from sheets of aluminum, using a special (and costly) tube socket with spring-finger stock contacts, an air duct chimney, precision-made anode resonators and so forth, but *why*? There are plenty of commercially-made *surplus* RF amplifiers out there which will tune up on 2 meters, available for less than the cost of a single tube. Problem is, most of the surplus comes without documentation, and often without a power supply. Many times a power supply was so big and heavy it was left behind when the amplifier was removed. Sometimes the original power supply was designed to be used on something other than standard 117 VAC power. Still, it is easier to find a high-powered "RF deck" (amplifier without a power supply) than it is a complete unit. So if you find a surplus "RF deck" for a good price, don't hesitate to buy it; the power supply is the easy part and, along with control circuitry, meters, and a relay or two, it can be converted into a great base-station amplifier for little cost or effort.

I stumbled across a beautiful VHF RF deck at the local swap meet. I've seen similar units at the Dayton Hamvention and in the pages of various surplus outlet catalogs. If you want to find a 2 meter RF deck, the key is to look for one that originally covered the 150 MHz band (typically 150-174 MHz) so little or no conversion to the RF circuitry will be required. The deck was unlabeled, but it *looked* like a VHF unit, and a quick check with my trusty Millen 90651 grid-dip meter confirmed that its plate tank circuit resonated at 150 MHz. When I got it home, I checked the tuning range of both the input and output circuits and was pleased to find it tuned right down to 140 MHz without modification.

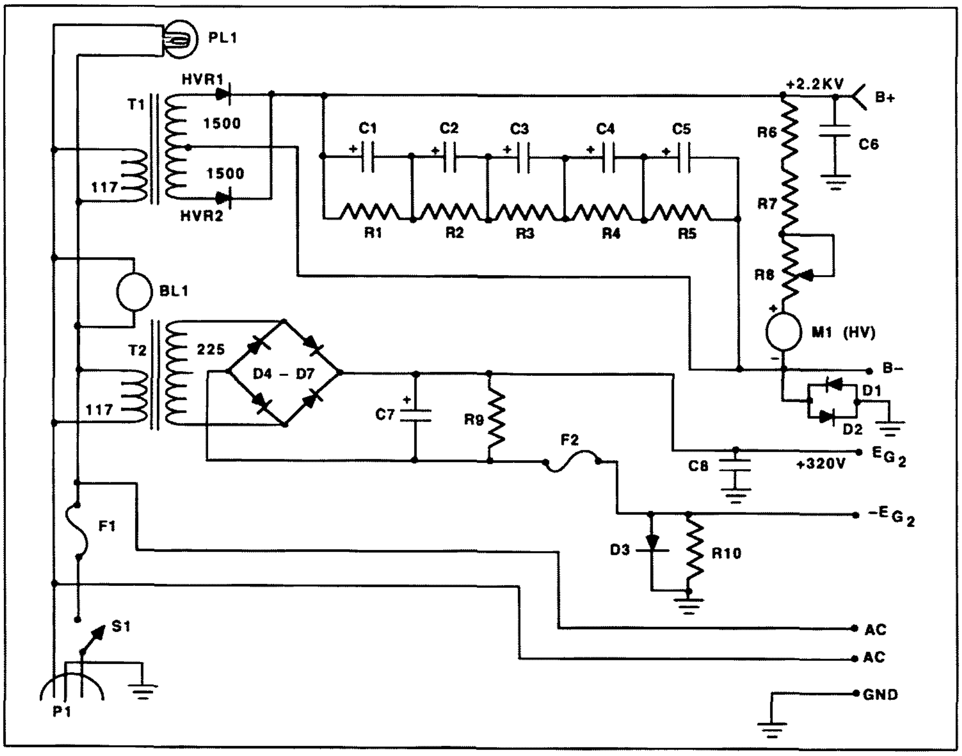


Figure 1. Plate and screen circuit for 2m half kilowatt amp power supply.

This deck (see photos) cost me $100, and was worth the price, since it contained an Eimac 8560A conduction-cooled power tetrode that normally retails for about $190; plus, the mating tube socket, beryllium-oxide thermal link, anode heat sink, and all tuning circuitry.

The 8560A is a conduction-cooled version of the famous 4CX250B, and its ratings are identical, but it requires *no* forced-air cooling, blower, air-system socket or chimney. It is rated for literally unlimited anode power dissipation, as long as the anode and base seal temperatures can be maintained below 250 degrees C, and this will be a function of power input, efficiency, and the size of the heat sink used. In the unit pictured, I was able to run 400 watts RF output power for about 20 minutes before the heat sink became uncomfortably warm—that's when I decided to add an outboard "muffin fan" to blow a cooling airstream across the heat sink. If you find a deck with a different tube (e.g., 4X150A; 7034; 4CX250B; 7203; 7580W;

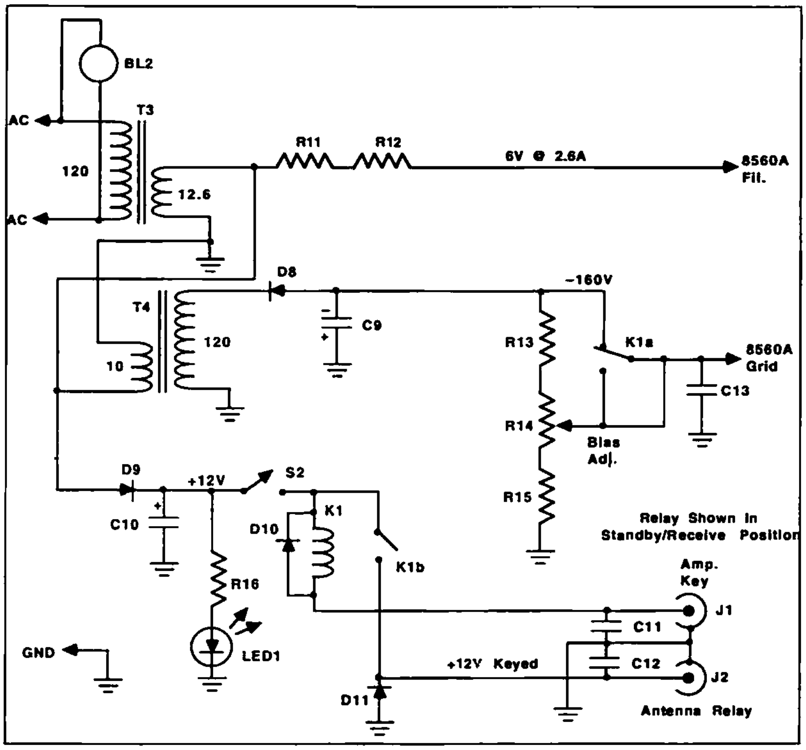


Figure 2. Bias, filament, and control circuit for 2m half kilowatt amp.

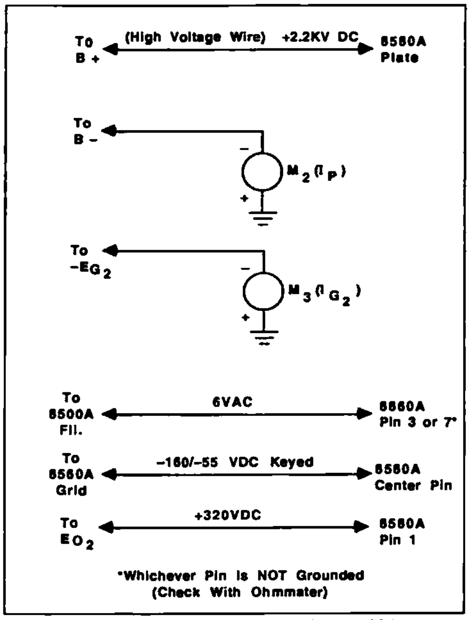


Figure 3. Interconnections for 2m half kilowatt amp.

or 4CX250R) it should still work fine, but if they require air-cooling you'll need to make sure that the original blower, chimney and ductwork are operational.

I decided to make one initial change to the RF circuitry. I noted that the manufacturer used mica chip capacitors to bypass the screen pin of the tube at its socket, but used no further decoupling close to the tube base. This is a huge "no-no" that could result in unstable operation, so I added a 220 ohm, 1 watt *carbon* resistor in series with the screen lead, right at the tube socket, and bypassed the "power supply end" of this resistor with a 0.01 µF, 1 kV ceramic disc capacitor (zero lead length) to ground. This adds considerable RF decoupling for the screen and is recommended for any power tetrode that is not operating grounded-grid. I'd found from many years of experimenting with similar tubes that a carbon resistor works better than an RF choke at this point in the circuit since it offers more wideband decoupling with little fear of resonance and regeneration (instability). It is safe to use a resistor in the screen lead, as it is in the grid bias lead, since the current drawn by these elements is very small.

The Power Supply

The next step was to design and build a modest power supply for the amplifier. The power supply circuit is very simple. The high-voltage (plate) supply is a simple full-wave, center-tap rectifier providing 2200 VDC at 500 mA, filtered by five 250 µF, 450W VDC electrolytic capacitors in series. The total filter capacitance is 50 µF, quite a lot for a 500 mA load. Each capacitor is paralleled by a 50k ohm, 20W wirewound resistor to equalize the voltage across each one. (Please note: Feel free to use something else, if you have it. A single, 20 µF, 2500 to 3000 VDC oil-filled capacitor would serve the purpose here.) The rectifiers are Semtech "Slimpac" type SCH7500, rated 7.5 kV at 500 mA each, found at the local swap meet for $2.50 each. This approach was cheaper and more effective than using big strings of lower-voltage diodes with bridging capacitors and resistors. If you can't find Slimpacs or something similar, "do your own thing" and come up with another solution. In lieu of each Slimpac, four type-1N4007 diodes in series with a 470k ohm, 1/2 watt resistor across each one would work.

To meter the B+ (high voltage), I used a 0-1 mA DC panel meter in series with two 2.4 megohm, 2W resistors and a 250k ohm "calibration" potentiometer, which is used to adjust the meter for accuracy. Because I wanted to meter both high voltage and plate current remotely from the power supply (the meters are on the RF deck), I used a separate "B-" (high voltage return) lead in the power cable between

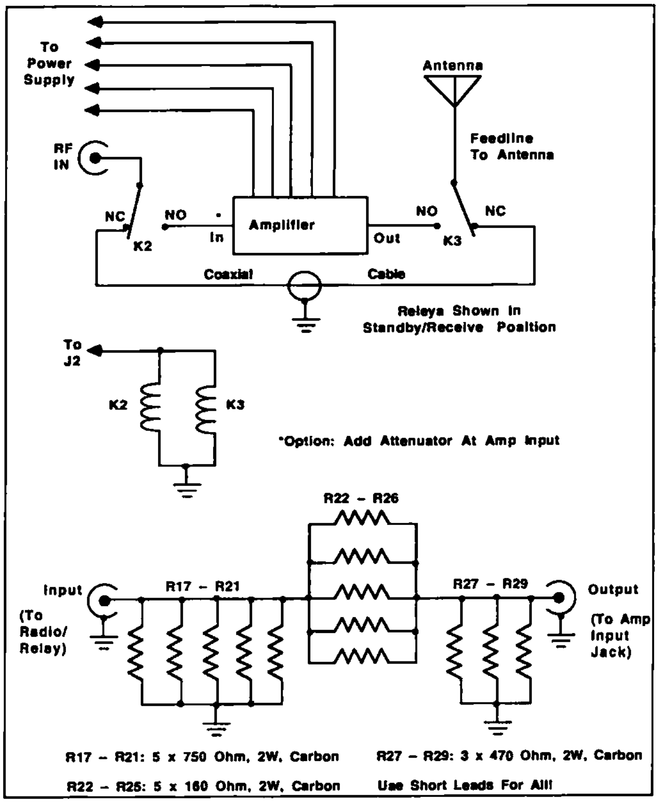


Figure 4. Station connection for 2m half kilowatt amp.

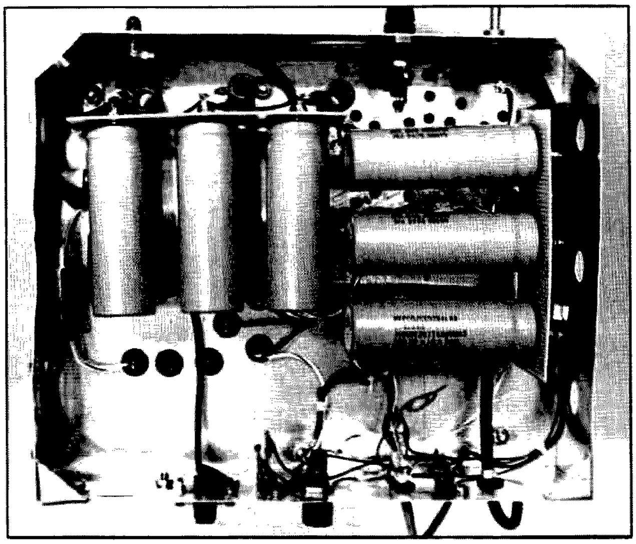


Photo C. View from under the power supply chassis. Note the six high-voltage electrolytics. The bleeder resistors are on the other side of the perf board.

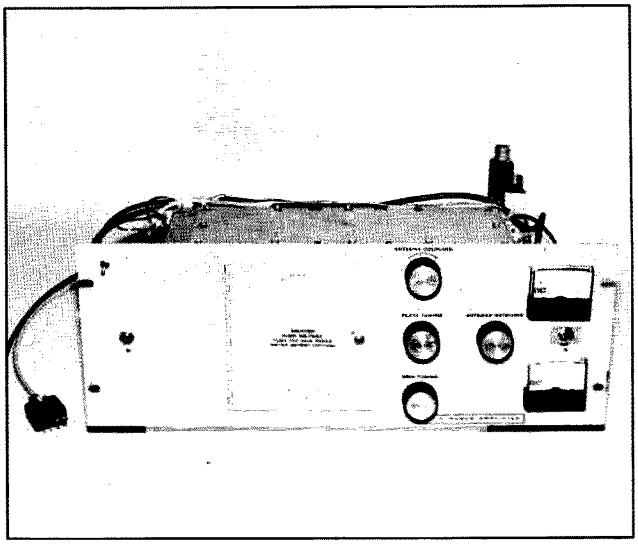


Photo D. The completed, modified RF deck now includes panel meters, a grid bias adjustment pot, and a standby switch.

them, and measured I_P (plate current) in the negative lead—*much* safer than measuring in the "+" lead, which is floating 2200 VDC above ground!

The screen power supply is a full-wave bridge rectifier which develops +320 VDC at about 25 mA. It is not electronically regulated, and many feel that screen supply regulation is key to linearity in tetrode amplifiers. However, it is very stable because the supply is very well filtered by a 250 µF capacitor and a 10k ohm, 20W "bleeder" resistor provides a 32 mA constant load. This load is about 10 times more than the screen current drawn by the tube itself, so the supply voltage doesn't change when the amplifier is run from "key up" to "key down." Electronic regulation with gas tubes or zener diodes wouldn't be much better than this.

For the screen current, negative-lead metering is also used. I used the same 0-1 mA meter that is used for plate current, with a 0.5 ohm, 1 watt precision resistor as a meter shunt. The shunt resistor is located in the power supply, not across the meter itself, to keep the return lead close to ground potential. Possibly the screen current needn't even be monitored, since in operation the amplifier rarely draws any measurable screen current. However, monitoring screen current is useful for tuning the amplifier. You'll also note on the schematic that I used a 1/16 amp, fast-blow fuse in the screen return lead. This will open in the unlikely event the tube tries to draw excessive screen current. (This series of tubes has grid and screen structures which are far more fragile than the cathode or plate, and excessive screen current destroys more power tetrodes than almost any other problem.)

By the time I was finished building the plate and screen power supplies into the little 10" x 12" x 3" chassis, there wasn't much room left for the filament transformer and grid bias power supply. Besides, I wanted to mount a "muffin" fan on the power supply chassis to exhaust the hot air generated by the plate and screen "bleeder" resistors. After all, 35 watts are being dissipated under this power supply chassis, beginning immediately after the "ON" switch is thrown.

No problem: There was sufficient room on and around the RF deck panel to mount the rest of the components necessary for operation. Before mounting sensitive parts like meters and relays, I performed all the drilling and hole-punching. Punching the 1-3/4" holes required for the two meters was a real task because this particular amplifier deck used a solid-steel 1/8"-thick panel. Ugh! Using a "wrench-handle extender" on the socket wrench turning the lead screw to a chassis punch, and after much grunting and groaning, the meter holes were finally completed.

I mounted the filament transformer, bias transformer, relay (to switch bias for the tube and to activate the antenna relays) and other components on the left-hand side of the panel and the rear chassis of the RF deck. Why did I use a 12.6 volt filament transformer for a 6 volt tube filament? Because I *had* one, that's why! And a conventional filament transformer of 6.3 volts would provide excessive voltage for the tube filament, anyway—these tube filaments are rated 6.00 VAC at 2.6 amperes and they do *not* last long with 6.3 volts applied to them. So, a small resistor (or a Variac on the transformer primary) would be required in either case. I used 2.5 ohms total resistance between the 12.6V transformer and the tube filament: one 2.2 ohm, 20W and one 0.3 ohm, 5W wirewound (precision) resistor, both purchased from All Electronics for a total of $2. This results in exactly 6 volts AC at the tube base.

I found a 120V:10V transformer for about a dollar and used it, wired in reverse, to provide grid bias from a half-wave rectifier circuit. The bias rectifier and filter produce -160 VDC (remember, grid bias is *negative*, so the rectifier and capacitor must be wired as shown) which is then adjusted to the proper levels with a three-resistor voltage divider made up of the 3.5k ohm, 10W; 1k ohm, 5W potentiometer; and 1.75k ohm, 5W resistors shown on the schematic. The relay K1 switches the operating bias to the tube from -160 VDC (cutoff, for "standby") to about -55 VDC ("operate") when activated by an outside keying source that simply goes to ground on transmit. Most rigs have such a keying line. The power for the relay coil comes from a small rectifier/filter circuit that is driven by the 12.6 VAC line from the filament transformer. I also used reverse-voltage "spike" suppression (in the form of a diode across the relay coil) to prevent "kick-back" voltage from the relay coil from damaging sensitive keying circuits in the radio used to key the amp.

Even if you don't understand its theory, you can make this amplifier *work*! If you follow instructions and schematics exactly, and have someone check your wiring, the thing *has* to work. It's essentially foolproof.

I used another set of contacts on relay K1 to provide +12 VDC for keying the antenna relays, which are a pair of conventional "Dow Key" (Kilovac Corp., Santa Barbara, California) RF relays which bypass the amp on receive ("standby") and place the RF amplifier circuit in the line on transmit. I also added a "standby" switch. This switch breaks the DC line to the relay K1 so that it will not key, even when the exciter is keyed to transmit. Thus, with the switch in "standby," the exciter will run straight through the antenna relays and run "barefoot"; with the switch in "operate," the amp will be keyed into the line. What could be simpler? (The Kilovac Dow Key relays are extremely high-quality devices offering better performance at VHF than the circuit-board-mounted re-

Construction Tips

(1) *Be careful.* There arc lots of hazards associated with construction and operation of this equipment, especially when lethal voltages are involved. Even the mechanical work can be hazardous: You'll be using hacksaw blades, drill bits, chassis punches and other sharp tools. Work slowly and carefully, minding the old saw, "Measure twice, cut once," and you'll be more assured that all the cutting will be on the metal and not on your fingers. Use only high-voltage insulated wire for all the plate voltage wiring: the correct wire isn't expensive or rare.

(2) Don't operate high-powered equipment without all shielding covers in place. Load the amplifier only with a shielded dummy load connected by a well-shielded coaxial cable, or an antenna located at least 20 feet from your operating position and other people.

(3) Don't meter the B+! If you want to measure plate current, meter the B- (plate voltage minus return lead) instead. Plastic-faced meters are not rated to withstand 2200 volts and represent a hazard.

(4) Operate only equipment using three-wire AC power cords, with the ground lead firmly connected to the power supply chassis and the plug installed in a three-wire grounded outlet. When wiring the AC line cord in the power supply, make the ground lead (usually green) the *longest* wire, an inch or two longer than the "hot" lines (black and white), so that in the event the line is pulled very hard from the chassis, the ground lead will be the *last* to break or become disconnected.

(5) Cover or protect all exposed potentially hazardous connections, including the 117 VAC line. Use a generous "glop" of RTV sealant and allow it to cure before turning anything on. And even then, be careful.

(6) Some of the resistors in the schematic will dissipate a lot of power, generating considerable heat. Their surfaces get hot enough to burn your skin, even when operating within their ratings. Conceal these so they are out of reach and be careful not to touch them during and immediately after operation.

(7) Use expert soldering techniques. Don't just wrap stranded wire around or through a terminal point and solder—it's bound to have stray "whiskers" which could short against other surfaces. Pre-tin all stranded wires carefully before wrapping and soldering. This is not just safer, it's more attractive. Take pride in construction—it only takes a little effort to do a professional job.

(8) When measuring the output of this amplifier, use only an instrument which can be trusted at this frequency and power level. The Bird Electronics Model 43 Thruline is an appropriate instrument. Many wattmeters are sold that proclaim very wide bandwidth and power ratings (e.g., 1.8 to 144 MHz, 20 to 2000 watts all in one meter), but these are not precise instruments, and they are not only unlikely to measure accurately but they may even burn up.

(9) Use *real* coaxial relays. The best deals are on surplus "Dow Key" type coaxial relays. Use either two SPDT (single-pole, double-throw) coax relays back-to-back as shown, or a single DK260 type DPST coaxial bypass relay, which is specifically made for this application. I've seen the DK60 variety (SPDT Dow-Key with UHF connectors) at swap meets for $15 each surplus. These are great buys! Very little else has ever been manufactured that works as well for so reasonable a price.

(10) Use coaxial cable capable of handling this power at 144 MHz. RG58/U and similar small-diameter cables will *not* cut it, even for very short jumper connections. RG8X ("Mini 8") might work, but you'd be better off using cable that is well within its ratings at 400W and 144 MHz, such as RG213/U, 9913, etc.

(11) Whichever RF deck you start out with, get a copy of the manufacturer's data sheet on the tube and heed its advice. Most of these external-anode tetrodes require 120 seconds warm-up time before applying operate bias and drive. If you inadvertantly key the amp shortly after turning it on, you risk blowing the tube—and as "cheap" as they are, a new one can cost from $65 to $170, depending on which tube you use.

lays in commercial solid-state amplifers. Unlike the little relays used in solid-state amps, these big units have absolutely *no loss* at 144 MHz, and perform very well up to 500 MHz. They are expensive, but can be found surplus for about $15 each.)

You might notice that I didn't meter the grid current. Feel free to do so! But this amplifier is so easy to drive that I added a 3 dB, 50 ohm attenuator ("pad") in series with its input jack. I still turn the RF drive level on my exciter, a Yaesu FT736R, nearly all the way down when I use it, preventing excessive grid current. I have measured the 8560A grid current during bench tests by breaking into the bias circuit with my trusty VOM, and the grid current for proper operation is just about zilch. It kicks to maybe 1 mA on voice peaks on SSB when running the amplifier at 400W PEP output power. Not bad! Since this tube is rated for 2 watts grid dissipation, the grid current could be as high as 18 mA or so in linear service, but drawing this much grid current means something is very wrong. Believe me, there's no reason for any grid current to flow in order to produce a strong and healthy signal.

I used silicone-based RTV sealant on all exposed potentially hazardous connections, the most hazardous of which is probably the 117 VAC line, which has exposed connections at the fans and on the screen transformer.

Results with this $1 per watt amplifier have been gratifying. (Note: The $1 per watt includes the cost of the original RF deck, plus all power supply components, RF relays, meters, fans, power supply chassis, cables and cords, etc., and still leaves room in the budget for buying QSL cards to confirm all the great contacts you will make. The amplifier has a power gain of about 250:1 until it saturates and requires only 2 watts drive for full (400W) output power. To achieve 200W output, less than 1W drive is required. Driving with my ICOM IC2AT "handie-talkie" just for fun (and keying the amp with a clip-lead to activate the relays), the unit produced more than 50 watts output when using the HT in the *low power* position (rated 150 mW output)! Just try to do *that* with transistors!

I used this amp on-the-air in the "VHF Spring Sprints" 2 meter mini-contest the evening of April 9, 1990, and made contact with every single station heard, including many up in the Bay Area, some 400 miles to the north. I used a little F9FT "Tonna" portable yagi, nine elements on a 10' long boom, temporarily installed on a Radio Shack 19" "slip-up" mast. My location for this four-hour exercise was Saddle Peak, a 2800' hill very close to my home.

Tuning this amplifier couldn't be simpler: Apply power to the amplifier and, after waiting two full minutes for the tube to warm up, key the amp with *no* drive power and adjust the "idling" plate current to about 80 mA using the grid bias adjust potentiometer (1k, 5W resistor in the grid bias circuit). Then apply a *small* amount of RF drive and peak all controls on the amplifier for maximum RF output power. Apply slightly more drive and repeak for maximum output. When the RF output reaches about 400 watts after everything is peaked, reduce the drive slightly until the output drops off just a bit, maybe down to 375W or so. No further tuning is required.

When the amp is properly tuned to resonance and maximum output, the I_P (plate current) should be about 300 mA, screen current anywhere from zero to 5 mA, and grid current nearly zero. If you use my pow-

er supply design and are connected to a "stiff" 117 VAC line (normal house wiring should be sufficient), the plate voltage will be 2200 VDC "key up" and 2000 VDC "key down" at full power. Of course, this will depend on exactly what plate transformer you use.

Don't be afraid to experiment! The 4CX250 family of tubes, including the 8560A used here, will perform very nicely with plate voltage anywhere from 1600V to about 2500 VDC. Screen voltage can be from about 275V to 365 VDC, as long as it is stable. The operating bias should be adjustable, as shown, to allow for variations in the other voltages and in the tubes. The amplifier power gain will not be quite as high as I've stated if you use reduced plate and/or screen voltages, but it will still have a *lot* of gain, especially compared with solid-state.

Eimac only rates the tube for a maximum plate voltage of 2000, so using this series of tubes at higher plate voltages is done at the user's risk. However, I've used these tubes for years at 2500 VDC with no ill effects. As stated earlier, filament voltage, screen power and grid power are the critical parameters on these tubes, much more so than plate voltage or even plate power.

Any deck using this series of popular tubes and originally intended for VHF service should work. Try Fair Radio Sales. The military surplus AM-912/GRC is a wonderful unit that Fair has sold for years for about $90 (a great buy!) which tunes 100-225 MHz and uses a single 4X150A. But there's a multitude of commercially-made RF decks out there using these tube types, and many will cover the 2 meter ham band. Since a new tube, socket and chimney for a 4CX250B will cost much more than $100, any amplifier using them and available for about this price is a terrific deal.

A bit of scrounging, and a few hours work building the power supply and control circuitry described here, is all it will take to be a "big signal" on 2. Oh, by the way: I'd stay away from FAA VOR transmitters for use on 2 meters. Since they were designed for frequencies much lower than 144 MHz, my experience has been that most won't tune up to 2 meters, and the conversion to the RF circuitry isn't worth the effort.

Please feel free to write me (21101 Celtic Street, Chatsworth CA 91311; Fax: 818-349-8264) with questions regarding this, or the conversion of other commercial/military gear which will make useful amplifiers for VHF/UHF service. I've converted a lot of them, but many require literally no conversion. Good luck, and good DXing on 2 meters!

Surplus Electronic Outlets Likely to Have RF Decks and Other Required Parts

All Electronics Corp.
14928 Oxnard St.,
Van Nuys CA 91406 (800) 826-5432
(Miscellaneous electronic parts.)

Apex Electronics
8909 San Fernando Rd.
Sun Valley CA 91352
(Miscellaneous electronic parts, especially power transformers, HV capacitors, relays, meters, etc.)

Davilyn Corp.
13406 Saticoy St.,
No. Hollywood CA 91605
(Miscellaneous electronic parts including complete RF decks, power tubes and sockets.)

Fair Radio Sales
1016 E. Eureka, (P.O. Box 1105)
Lima OH 45802 (419) 227-6573
(Miscellaneous electronic parts including complete RF decks, power tubes and sockets, blowers, transformers, capacitors, etc.)

Surplus Sales of Nebraska
1502 Jones St.
Omaha NE 68102 (402) 346-4750
(Miscellaneous electronic parts including complete RF decks, power tubes and sockets, etc.; also Ten-Tec cabinets, Collins parts, etc. to dress up your project!)

Tucker Electronics
1717 Reserve St.
Garland TX 75042
(214) 348-8800, (800) 527-4642
(Sometimes has complete, operational equipment.)

All these dealers publish catalogs or flysheets featuring their current "goodies," and all sell by mail order. Fair Radio has been an excellent source of complete RF decks, with or without power supplies, for a number of years. If you don't see one in their catalog, call them! Also search your local flea markets or swap meets, and contact your local two-way radio shops (found in the Yellow Pages) for possible surplus commercial gear taken out of repeater service.

Parts List

BL1, BL2	Rotron "muffin" fans, 4-1/2" square, 117 VAC
C1-C5, C7	250 µF, 450V electrolytic
C6	0.001 µF, 3 kV ceramic
C8, C11-C13	0.001 µF, 1 kV ceramic
C9	250 µF, 250V electrolytic
C10	1000 µF, 25V electrolytic
D1-D11	1N4007 (1000 PIV, 1A rectifier)
F1	10A 125 VAC "slo-blo" fuse
F2	1/16 125V 3AG fuse (special item)
HVR1, HVR2	Semtech SCH7500 or equivalent (7.5k V PIV, 500 mA rectifier assemblies)
J1, J2	RCA phono receptacles
K1	DPDT relay, 12 VDC coil (non-critical: Radio Shack item or surplus)
K2, K3	DK60 Dow-Key SPDT coaxial relays
LED1	High-intensity LED, panel mount
M1	0-1 mA DC panel meter (will read 0-5000 VDC plate voltage when used with R6-R8)
M2	Plate current meter: Can be 0-500 mA DC used without shunt; or, a 0-50 mA DC meter may be used with a 0.1 ohm shunt resistor; or, a 0-5 mA DC meter may be used with a 0.01 ohm shunt resistor. Use whatever you can find, and select shunt value as appropriate.
M3	0-1 mA DC panel meter (will read 00-100 mA DC screen current when used with R10).
P1	Three-prong (grounding) 125 VAC plug, 15A
PL1	125 VAC pilot lamp assembly, panel mount
R1-R5	40k ohm, 20 watt wirewound
R6, R7	2.4 megohm, 2 watt, 1% or 2% precision high voltage resistors (ceramic or glass insulation)
R8	250k ohm, 1 watt potentiometer (HV meter calibration)
R9	10k ohm, 20 watt wirewound
R10	0.5 ohm 1% or 2%, 1 watt precision
R11	2.2 ohm, 20 watt wirewound
R12	0.3 ohm, 5 watt wirewound
R13	3.5k ohm, 10 watt wirewound
R14	1k ohm, 5 watt wirewound potentiometer (grid bias adjust)
R15	1750 ohm, 5 watt wirewound
R16	680 ohm, 1/2 watt carbon
R17-R21	750 ohm, 2 watt carbon (only): Do *not* use wirewound.
R22-R26	160 ohm, 2 watt carbon (only): Do *not* use wirewound.
R27-R29	470 ohm, 2 watt carbon (only): Do *not* use wirewound.
S1	SPST, 15 amp rated AC toggle (AC power ON-OFF)
S2	SPST, 3 amp rated mini toggle (STBY-OPERATE)
T1	Plate transformer, 117 VAC primary: 3000V C.T. (center-tapped) secondary, 1/2 ampere continuous rated (a 750 mA "intermittent duty" transformer is okay).
T2	Screen transformer, 117 VAC primary: 225V secondary, 100 mA rated.
T3	117 VAC primary: 12.6V secondary, 3 amps continuous rated. Could be different secondary voltage (6.3V, 10V, etc.) but if a different rating is used, this will affect the values for R11, R12, R13, R14, R15, etc. Recommend staying with the original rating shown unless you like to experiment.
T4	117 VAC primary: 10V secondary, 1 amp rated (wired in "reverse" as shown on schematic, with the 10V winding used as the primary for this design).

Using International 9096-IIA

Xtra-flex, low-loss coaxial cable.

by Steve Katz WB2WIK/6

My article called "The Hows and Whys of Coaxial Cable" in the May 1993 issue of *73* created a lot of reader response. Some readers asked about low-loss 50 ohm coax, which is more flexible and easier to use than the popular Belden 9913 but still has the same excellent electrical properties. I've been using Belden 9913 since its first appearance on the market about eight years ago and I've always had very pleasant results, although there are some caveats in the use of this air dielectric cable which I discussed in the May article.

I've searched for years for a suitable substitute for Belden 9913, not because I don't like the Belden product, but simply because it's not flexible enough for some applications. (The original 9913 has a #9 solid center conductor which makes the cable quite rigid.) In contacting the vendors of substitute cables, I found that most were not actual manufacturers, but rather distributors of wire and cable products who were very reluctant to reveal their sources of supply. Often these distributors have their own brand names imprinted on the cables they sell, giving the appearance that they actually have production operations. This is quite common in the wire and cable industry, and many "master distributors" like Alpha Wire Corporation (Elizabeth, New Jersey) have done business for many years and developed excellent reputations. Still, I've been reluctant to recommend distributors as product sources, feeling that if they don't manufacture the product, they have little or no control over it. Sure, we buy ham rigs, computers, TV sets and automobiles from distributors, but we know who made these items and we have the option of contacting the manufacturers directly for technical assistance, problem solving, and so forth, so we feel comfortable about our purchases.

Substitutes for 9913

I've tried products sold by a number of distributors and found some were better than others. I found at least one 9913 substitute, sold by an amateur product distributor who specializes in wire and cable, to be of such poor quality that I literally couldn't strip it. This cable's dielectric was so tightly bonded to its center conductor that it was nearly impossible to remove, but at the same time the dielectric was so poorly bonded to the aluminum-mylar film outer conductor that all attempts to remove the jacket resulted in pulling the dielectric and center conductor right out the end of the cable! This stuff was terrible.

> ***"How does it work? In a word, 'great.' In two words, 'I'm impressed.'"***

There's a brand-new product on the market from International Electronic Wire and Cable called 9096-IIA "Extra-Flex." This is another "9913 clone," but it's the best I've seen so far. It is similar to Belden 9913 (described in the sidebar), but instead of having a solid center conductor it has a 19-strand conductor of #9 overall gauge, which makes it very flexible and easy to use. The 9096 bends and flexes as easily as conventional RG8/U or RG213/U, but has far lower loss due to its construction and material content. 9096 has an outside diameter (o.d.) of 0.405" just like mil-standard RG213/U and will accept a standard "UHF" type PL-259 fitting; however, due to its oversized center conductor, it will not fit a standard UG21/U type "N" and must be fitted to a special type N, the kind sold for use with Belden 9913 (how convenient!). I took delivery of 500 feet of 9096 as soon as I heard about it, in part to lab test it but also to potentially use the new product to feed my recently installed 6 and 2 meter beam antennas.

How does it work? In a word, "great." In two words, "I'm impressed." Before installing the cable in my station, I measured its attenuation on the 28, 50, 144, 222, 440 and 1270 MHz bands, where it is most likely to be used in the average ham station. (Its low-loss characteristic would be almost wasted below 28 MHz, as conventional RG213/U is good enough for the majority of installations in the HF spectrum.) This data is shown in Table 1, which compares the loss of 9096 per 100 feet to the loss of conventional mil-standarcd RG213/U (which is the current successor to old-fashioned RG8/U). To make this measurement, I used all 500 feet of 9096 and installed type N connectors on both ends, then divided the measured loss by five to yield "loss per 100 feet." This is more accurate than measuring 100 feet, as it offers five times greater measurement resolution.

9096 will handle the amateur legal power limit throughout the HF-VHF-UHF spectrum, although at very high ambient temper-

Continued on page 51

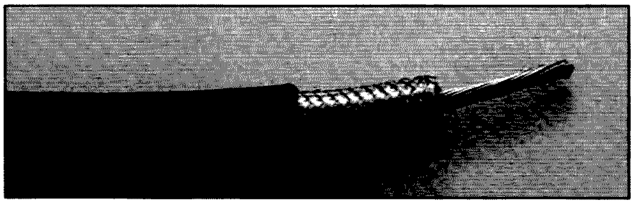


Photo A. The end of a piece of 9096 stripped and ready for installation of a "UHF" PL-259 connector. It strips easily and is a pleasure to work with: One razor blade and five seconds is all it takes to do this.

Photo B. A piece of 9096 with an end stripped and the tinned copper braid pulled back to reveal the aluminum-mylar film shield. You would not normally do this to install connectors. That #9 stranded center conductor is a healthy bunch of copper.

Using International 9096-IIA

Continued from page 48

atures or elevations it may require some derating. It features a type IIA polyvinylchloride (PVC) outer jacket material, which is tolerant to ultraviolet (UV) radiation and therefore requires no protection from the sun, unlike some commercial coaxial cables which can contaminate with UV radiation.

Since cable is a pretty simple product which is most readily assessed for attenuation and ease of use (and most other parameters are not terribly significant), I cannot report a great deal more about the merits of the new International product. It works, it works well, and is a suitable replacement for Belden 9913 for those situations requiring greater mechanical flexibility. Because 9096 is 100% shielded like the semi-rigid "hardline" cables are, it would lend itself well to repeater installations where single-shielded cables don't perform, due to RF leakage and noise generation caused by the braided outer conductor. See the sidebar for more details on construction of International 9096.

Now would be a good time to point out some of the limitations of helical dielectric cables including 9096:

1. This cable is flexible enough to be routed nearly anywhere, but great care must be exercised in its handling due to its internal construction. *Do not*: step on it; use nylon or metal cable ties or clamps to affix it to supports; "kink" it; bend and re-bend it back and forth at the same spot; make any bend of less than 4" internal radius, and if you make such a tight bend, be sure to do it only once in that spot; or place mechanical stress on it at any point where it makes a bend or is affixed to a support. (This is a lot of "do nots" but they are all important, and reasonably easy to follow.)

2. When installing a "UHF" type PL-259 connector, use a lot of heat applied for a brief period of time to get the solder to flow into the connector body holes (for braid connection), rather than a small amount of heat applied for a long period of time. Using a 260 watt soldering gun and soldering all the holes in just a few seconds is much better than using a 100 watt gun and taking 30 seconds to accomplish the task. During and for about five minutes after the connector soldering operation, do not move the cable at or near the soldered connector. Leave it alone so the dielectric can re-form to its intended state and establish a good insulator between the inner and outer conductors of the cable near the connector, or you risk a short-circuit.

3. If you need to affix the cable to a "hard" support such as an antenna boom or mast, tower leg, tower cable standoff arm or whatever, do not use many layers of overlapping vinyl tape pulled tight around the cable and its support—you'll short-circuit the cable at this spot. Instead, use many loosely-wrapped spiral-wound layers of tape, spread over several inches of cable and support. This will be just as strong and place much less stress on the cable.

Photo C. A piece of 9096 cut away (sectioned) to reveal its internal construction. If you look closely you can see the spiral turns of polyethylene dielectric, with 1/2" air spaces between them.

4. When "rolling out" the cable for use, *do not* uncoil a bunch of cable and let it lay around on the ground or roof and pull on a free end. This will surely cause destructive "kinks" in the cable. Instead, free up just one coil of cable to connect that free end to your antenna (or whatever), then gently and carefully unroll the cable using a hand-over-hand technique to roll the cable, allowing it to uncoil one turn at a time. If you see a "kink" form, flop the entire roll of cable over in the appropriate direction to "unkink" it, and then continue unrolling. With practice, you won't get any kinks at all. It helps a lot to have the cable wound on a wooden spool, so you can use a piece of 1-1/2" pipe inserted all the way through the spool to create a "handle" on each end. You can hold the pipe ends like handles, and just walk with the spool, allowing it to gently unspool itself. This way, no kinks will form and the whole process is not tiring at all.

> ***"This is a lot of 'do nots' but they are all important, and reasonably easy to follow."***

5. When making bends in the 9096, make them as gradually as possible, preferably 9" or greater in radius. I've experimented with this cable to determine it will accommodate a 4" radius bend, just once. If such a small radius bend is "un-bent" and bent again in the same place, it can create an internal short circuit in the cable. When making a "rotor loop" of cable to route around a rotator, make the loop as large as possible, but be sure that it won't snag on guy wires, clamps or other supporting mechanisms as the rotator turns.

If these precautions are followed, the cable will serve you well. Note that all these caveats apply to *any* helical-dielectric cable with air between the turns (9913 included), not just International 9096; the only difference is 9096 is so flexible that it is deceiving—it bends easily, but too much bending can destroy it.

Short Circuits

If you install a long section of 9096 and find that you've created a short circuit in the cable, you may be able to determine where the short is, so the whole length won't require replacement. Surely any point along the cable where it may have kinked and a kink's been "pulled out" during installation would be highly suspect. Also, any point where the cable makes a bend and that point is taped or otherwise affixed to a supporting structure would be suspect, as well.

If you inspect the line and can find no visible clue as to why the cable shorted, try using a high-quality directional wattmeter in the shack and transmitting into the cable on the highest frequency you can generate. Record both forward and reflected power readings. If they are both equal, the short circuit is very close to your transmitter. If the reflected power is considerably lower than forward, the short is farther away. If the short were all the way up at the antenna end, then the reflected power reading would

Continued on page 54

Frequency	Attenuation in dB/100 feet	
	9096	RG213/U
28 MHz	0.65 dB	1.20 dB
50 MHz	0.82 dB	1.62 dB
144 MHz	1.35 dB	2.40 dB
222 MHz	1.76 dB	3.78 dB
440 MHz	2.60 dB	5.71 dB
1270 MHz	5.13 dB	10.87 dB

Notes: Data from measurements taken by WB2WIK 7/93 on 500-ft. lengths of each cable type shown. No data taken for 903 MHz as transmitter was unavailable. Extrapolation indicates that at 903 MHz, 9096's loss would be approximately 4.0 dB, and RG213/U's would be 8.7 dB. 9096 may not support use above 2 GHz due to minor inconsistencies in center conductor spacing resulting from the use of soft materials. I recommend only "sweep-tested" cables above 2 GHz.

Table 1. Attenuation per 100 feet vs. operating frequency, International 9096 and MIL-STD RG213/U.

Using International 9096-IIA

Continued from page 51

be equal to forward power generated, minus two times the loss of the cable.

Say you're using 100 watts of power at 144 MHz, and 100 feet of 9096 cable. You know you have a short somewhere, but don't know where. You transmit into the cable and measure 100 watts forward power and 70 watts reflected power. You refer to Table 1 of this article to determine that 9096's loss per 100 feet at 2 meters is 1.35 dB. This means its "round-trip" loss for a signal generated by your transmitter, reflected back from the far end of the cable and back down to your wattmeter, is 2.7 dB. Thus, if the short-circuit were right at your antenna, 100 feet "down the line," you'd measure 2.7 dB less reflected power than forward power. 100 watts minus 2.7 dB is 53.7 watts. So, if your short circuit were at the antenna, you should measure 53.7 reflected power. But you didn't; you measured 70 watts, which means the short circuit is closer to your transmitter than 100 feet. 70 watts is 1.55 dB less than 100 watts, so the short circuit is "1.55 dB away." 1.55 dB divided by two is 0.775 dB. 0.775 divided by 1.35 dB (the loss for 100 feet of cable) is 0.574. This would place the short-circuit at about 57.4 feet from your transmitter.

This method of establishing where a short circuit in coaxial cable is located is a bit crude, as it relies heavily on the accuracy of your directional wattmeter, published data regarding line losses, and so forth. But it's better than nothing, and is probably about 90% accurate. Thus, if you were to cut your cable about three feet before and after the 57.4-foot point (that is, cut it at 54 feet and 61 feet from the transmitter end) and check the section of cable you've cut out of the line, there is a fair assurance that the short circuit would be located in that section. Not foolproof, but, again, better than no system at all. A more accurate assessment could be made using a time-domain reflectometer (TDR), but not many

What makes 9096 different from ordinary RG213/U (the successor to old-fashioned RG8/U) coaxial cable?

Instead of using a solid polyethylene dielectric and a #13 gauge center conductor as in RG213/U, 9096 uses instead a dielectric which is mostly air and a center conductor of #9 gauge. To hold the center conductor in place, securely centered between the cylindrical "sides" of the outer conductor, RG213/U uses solid polyethylene, a good dielectric material; 9096 uses instead a thin spiral of polyethylene with large air spaces between the turns of the spiral. This is called a "helical" dielectric, because its construction resembles a helix. The helix turns occur at 1/2" spacing in 9096, which is about as far apart as they can be without risking a short circuit at every bend in the cable. The closer together the helix turns are, the more mechanically robust the cable will be, but closer spacing will increase the cable's dielectric constant, slow down its velocity of propagation factor, and increase the cable's transmission losses. The farther apart the turns are, the more mechanically fragile the cable will be, but farther spacing will reduce the cable's dielectric constant, speed up its velocity of propagation, and decrease the cable's transmission losses. This is a trade-off, and International made an intelligent choice by using 1/2" spacing. It's a good compromise between attenuation and usability.

Because the dielectric constant is so much lower with this construction, 9096 can use a much larger center conductor diameter without decreasing the cables nominal impedance. 9096 is a 50 ohm impedance cable that uses a huge center conductor (19 strands of #21 copper wire) to decrease ohmic and "skin effect" losses and reduce attenuation. Popular "9913" cable, introduced by Belden in the mid-1980s and copied by many, is very similar in construction but uses a solid #9 center conductor, making it more difficult to flex. International calls its 9096 "Extra-Flex" and they're not kidding—it is very flexible indeed.

Another difference between 9096 and normal military cable types like RG213/U is the construction of the outer conductor. RG213/U uses braided copper, tightly woven to provide 95% to 97% coverage of the dielectric. This is good, low-loss material that has sufficient shielding for most applications, but it is not "100% shielded." Even RG214/U, which uses two silver-plated copper woven braids, is not "100% shielded," although it is about 99%. International 9096 uses two outer conductors and provides truly "100% shielding." The innermost of the conductors is an aluminum-mylar film which completely covers the dielectric and provides 100% shielding. However, it would be impossible to solder or clamp to this shield, as it is thin and fragile like household aluminum foil and aluminum is not readily soldered with standard materials. So, over the aluminum-mylar film is a tinned copper braid which offers about 95% coverage. This tinned copper braid is very strong and can be readily soldered to a PL-259 or clamped in a type N connector, just as one would do for the mil-standard cables.

"In essence, I'm giving up 1.8 dB on 2 meters at a cost savings of more than $400!"

So, although the outer diameter of 9096 is 0.405" just like RG213/U, its use of a largely air dielectric and an oversized center conductor allows it to have substantially less attenuation. Whether you'll notice the lower loss depends on what frequency you operate and how much cable you use. I would not recommend it for runs of less than 100 feet on frequencies below 28 MHz, as the difference in loss will be impossible to detect. But if you use 100 feet or more at frequencies of 144 MHz or higher, you *will* notice an improvement in station performance. If you refer to Table 1, you'll see that 9096 has less loss per 100 feet length (as compared with RG213/U) by about 1 dB on 2 meters, about 2 dB on 222 MHz, 3 dB on 440 MHz, etc. As you can see, the higher the frequency used, the more notable the improvement will be if you use 9096 instead of solid-dielectric cables.

The difference will also be more notable when long transmission lines must be used. For example, in my station, I need 250 feet of coax to feed my 2 meter beam, and another 250 feet to feed my 6 meter beam, since they are both located on a tower that is 200 feet behind my home. By using 9096 instead of RG213/U, I've saved about 2.5 dB in feedline loss on 2 meters—definitely a worthwhile improvement. I could save another 1.8 dB or so if I changed from 9096 to 7/8" "hardline" (solid-conductor, rigid cable), but at *very* significant expense. The 9096 costs about as much as good-quality RG213/U, but 7/8" "hardline" retails for about $2 per foot, plus its connectors can cost another $40 each or so. In essence, I'm giving up 1.8 dB on 2 meters at a cost savings of more than $400! But my first 2.5 dB station improvement came from using 9096, at an added cost of literally nothing! Each of us has our own sense of values, but for the $400+ I'm saving by not using 7/8" coax, I could take my family on a short vacation.

The only trade-off in using 9096 instead of RG213/U is that the International product—like all helical-dielectric "soft" cables—is more fragile, and more care must be used in handling and installation. If you choose to use it, and I recommend you do if it will improve your station performance at no added cost to you, just be *careful*. If you handle the cable as though it were a crate of fresh eggs it will serve you well.

hams have access to this piece of laboratory equipment.

I offer advice on all this because it is possible that many users of 9096 and similarly constructed cables will create a short circuit during installation, especially if the cable isn't handled with care. With experience and repeated use, you'll find 9096 is great stuff and short circuits will be avoided.

International 9096 is available from many wire and cable retailers. Look for those distributors who specifically advertise "9096-IIA Extra-Flex" rather than just "flexible 9913 type" cables, to be sure you're getting the product described here. It retails for about the same price as Belden 9913 or standard RG213/U (in the 69¢ per foot range for 100-foot lengths), making it a very attractive deal for those wishing to use flexible but low-loss coax. When you order, be sure to request a copy of International's 10-year warranty. Distributors should have no difficulty providing you with a copy of this document.

More About 9096

International Electronic Wire & Cable offers their 9096 and other products for sale through franchised distributors. For technical information, they may be contacted directly at 89-1/2 O'Leary Drive, Bensenville IL 60106. Their 10-year warranty on 9096-IIA states, ". . . cable is warranted against defects in material or workmanship for 10 years from date of purchase. Any defective footage will be replaced free of charge when shipped pre-paid with proof of purchase to (their address). This warranty does not apply to damage resulting from accident or misuse. Liability is limited to replacement only and does not include installation."

9096-IIA is rated by the manufacturer as follows:

Dielectric strength	3000 VDC (equivalent to 2121 Vrms AC, which would be 89,973 watts!)
Capacitance	24 pF/foot
Impedance	50 ohms
Velocity factor	84% (important to know in the design of phasing lines or transformers)
DC resistance	0.95 ohms/1000 feet
Attenuation	0.9 dB/100 feet at 50 MHz
	1.4 dB/100 feet at 100 MHz
	1.8 dB/100 feet at 200 MHz
	2.6 dB/100 feet at 400 MHz
	4.2 dB/100 feet at 900 MHz
	4.5 dB/100 feet at 1000 MHz

(Note: Attenuation ratings differ from actual test data taken by this author as shown in Table I, but not by very much. I measured the cable to be better than its ratings on all frequencies below 1000 MHz.)

UPDATES

Number 14 on your Feedback card

ASCII-to-Morse-Code Interface

If you wish to order the kit from Suncoast Technologies for the above-mentioned project (February 1994, page 36), the correct telephone number to call is (904) 596-7599.

Using the World's Most Accurate Frequency Standard

The above-mentioned project is a three-part series which appeared in the January, February, and March 1994 issues. There is a slight error on the PC board layout for Part 1, the WWVB Receiver, which appeared in February, page 23, Figure 5. Shown below is the correct foil pattern and a simple cut-and-jumper fix for the one we printed. The RF amp will still work without this fix; it just won't work very well.

(a)

(b)

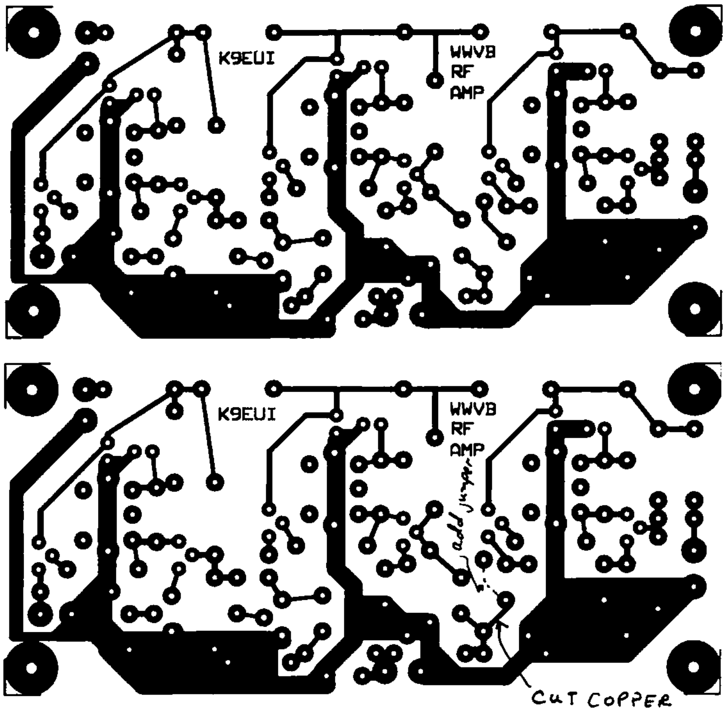


Figure 1.a) New artwork for the WWVB Receiver. b) A simple cut-and-jumper fix for the original artwork.

HAMSATS

Number 15 on your Feedback card

Amateur Radio Via Satellites

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Houston TX 77083

The Shuttle Amateur Radio EXperiment (SAREX) has been flying into space for over a decade. Since Owen Garriott W5LFL went up on STS-9 in November 1983 with a Motorola handie-talkie, small tape recorder and a curious in-the-window antenna, many missions have followed with amateur radio on board.

There have been missions with slow-scan television (SSTV), fast-scan television (FSTV), packet and voice. Figure 1 shows the four different configurations currently supported. Changes to the equipment list occur on a regular basis as new headsets, tape recorders, antennas and connectors are developed.

SAREX has several objectives. The primary one is to encourage children to pursue careers in science and mathematics and to show that there is a connection between education and real-life activities. Another goal is to promote public interest in space activities and amateur radio. SAREX also provides a means to conduct scientific experiments with amateur radio, to promote international goodwill, and to provide a meaningful recreational activity for shuttle crew members.

It takes more than just a radio and an antenna to fly a SAREX mission. Even the voice-only mode includes 12 items. When running "the works" the system has more gear than most amateur-radio home stations. One astronaut on STS-56 (configuration D) said the SAREX set-up was like "a dark closet full of black spaghetti." Another comment referred to the operation as a Field Day station in the dark. A close look at all the equipment in configuration D reveals a very complex setup. Imagine the gear either floating around or velcro'd to available flat surfaces. Then turn the lights down and try operating!

Hundreds of hams, other volunteers and NASA individuals who recognize the importance of SAREX keep the program running. Some are involved with school selection, contact scheduling, telephone bridge coordination when needed, hardware testing, maintenance and logistics, astronaut training and licensing. The astronauts who pursue their licenses and operate the equipment from space invariably become enthusiastic supporters. Bill McArthur KC5ACR was asked if he had any suggestions for future SAREX crews after he came back from STS-58 in November 1993. Bill thought for a moment and commented that his only suggestion was that SAREX should be flown on all missions.

Although personal contacts and general ham QSOs are fun, school contacts really keep the crew members' interest and bring more astronauts into ham radio. For the kids, there is something special about talking directly to an astronaut orbiting the Earth. For the astronauts, it's the satisfaction of bringing the adventure of space exploration directly into the classroom and perhaps inspiring students to pursue interests in science and engineering.

During STS-58, 17 scheduled school contacts were made. One was with a school in France. In addition, the audio was distributed via ham radio to more than 10,000 French students in other schools, so they could listen in on the contact too. For many amateur radio operators, listening to the shuttle downlink during a school pass is better than listening to random contacts with other hams. But for all hams, the real thrill is to make a personal voice or packet contact direct with SAREX.

Recent missions have been great for random ham contacts. In 1993, the SAREX working group drafted a new set of SAREX contact guidelines to better define school contact activity and general ham QSOs. A list of proposed schools must be provided to NASA seven months prior to launch. This means that applications from schools to the American Radio Relay League (ARRL) must be submitted and accepted even earlier. The total number of SAREX school and experimental activities, excluding personal flight crew scheduled contacts, are not to exceed two per day for the duration of the mission. Personal contacts are typically limited to one per crew member and are usually accomplished through telephone bridges made outside the mainland U.S.

SAREX organizers have recognized that contacts with the general ham population are essential. The flight crew is encouraged to make voice or packet contacts with hams whenever possible. During STS-58, KC5ACR, KC5AXA and KC5CKM made many voice contacts and logged hundreds of packet connects and full QSOs using the W5RRR-1 packet robot. When SAREX is left unattended during a flight, the packet system is activated in robot mode as much as possible. During STS-60 in early February, the robot system was very busy due to the focus of crew efforts on difficulties with the Wake Shield Facility experiment. While many would have preferred to hear more voice operation, others recalled earlier missions that had no ham activity at all on many passes. The ham-astronauts for STS-60 included Commander Charlie Bolden KE4IQB, Mission Specialist Ron Sega KC5ETH and Cosmonaut Sergei Krikalev U5MIR, also known as UZ3AK.

How to Work SAREX

The July 1993 "Hamsats" column covered the procedures necessary to successfully make a contact with the ham station on the shuttle. It's very competitive and usually more difficult than amateur satellite operation. The column described methods for tracking the shuttle, operating with voice or packet and getting a QSL A brief summary of the process includes knowing when to listen, what frequencies to use for packet and voice, and what to expect.

Preliminary orbital element sets for use with computers are always posted to packet and telephone bulletin board systems (BBSs). While they provide an idea of what type of orbit the shuttle will have for a particular mission, they are rarely accurate, due to launch rescheduling. Shortly after launch the data is updated and is again distributed. During the mission this information can also be obtained from ARRL bulletins at 9:45 p.m. and 12:45 a.m. EST on 3.99, 7.29, 14.29, 18.16, 21.39 and 28.59 MHz. The Goddard Amateur Radio Club in Greenbelt, Maryland, carries news and shuttle retransmissions on 3.86, 7.185, 14.295, 21.395 and 28.65 MHz. The Johnson Space Center Amateur Radio Club in Houston, Texas, also carries news and retransmissions on 3.85, 7.227, 14.280, 21.350 and 28.40 MHz.

For those without tracking software, tabular listings are posted via packet and phone BBSs with antenna headings and access times for many major cities in North America and the world. Two phone BBSs that carry the information are the NASA Spacelink computer at (205) 895-0028 and the ARRL BBS at (203) 666-0578.

The common downlink for all general or random ham activity is 145.55 MHz FM. This is for both packet and voice. If nothing is heard during a pass, then the SAREX equipment is either off or being used for a personal or school contact on another, usually nearby, frequency. If the monitored signals are not on 145.55 MHz, do not attempt a contact—it will only interfere with a scheduled activity that uses a non-standard uplink.

The packet system uplink is 144.49 MHz. The SAREX gear is not set up for simplex. All activity is split-frequency. For voice over North America, there are five possible uplinks, including 144.91, .93, .95, .97 and .99 MHz. The ham-astronaut will typically listen wherever he or she can get the best contact and will tune to another channel if congestion is high or no signals are heard. There are three European uplinks on 144.70, .75 and .80 MHz. These are not used over North America for general contacts.

During voice contacts, transmissions will be short and usually only include the exchange of calls and names. Many stations are usually listening and trying to get in, so brevity is vital.

On packet the callsign of the "robot" is W5RRR-1. Figure 2 shows a sample of packet activity monitored during STS-

Photo A. STS-57 Pilot Brian Duffy N5WQW operating SAREX in late June 1993 on board the shuttle Endeavour. *(NASA photo.)*

Photo B. STS-58 Mission Specialist Bill McArthur KC5ACR made many voice contacts on 2 meters using the SAREX gear on the space shuttle Columbia *in late October 1993. (NASA photo.)*

60. When a connect request is received by the robot, a QSO number is sent. If the number is acknowledged, the robot will send a disconnect to the ground station and the contact is complete and logged in the SAREX terminal node controller (TNC). Since many stations are simultaneously trying for a contact, the odds are high that a complete sequence of transmissions between the robot and ground station will not occur. It should only take between 10 and 30 seconds from the time the connection is established 'til the "disconnected" message appears. If more than a minute has passed, manually disconnect and try again. Complete contacts are shown in a "QSL" list broadcast by the TNC, and incomplete contacts are in the "QRZ" list. The TNC stores the QSL list, but not the QRZ list. It is up to the ground station to capture QRZ-list data since the shuttle lap-top computer may not be available for logging packet activity.

With hundreds of stations attempting to make contact, it is good practice to only make one contact and then listen for the remainder of the mission. Only one QSL per mission will be available for each callsign submitting a request.

To get a QSL for a contact or SWL report for STS-58 or STS-60, send your card with a self-addressed stamped envelope (4" x 9.5") to the ARRL, Educational Activities Department, 225 Main Street, Newington CT 06111. Be sure to note the mission number on the outside of your envelope. Expect a long delay, sometimes up to six months. The photo for the shuttle QSL is not selected until after the mission. The cards are then printed based on the volume of requests. Volunteers take it from there to get the replies out.

What's Next

STS-59 is currently scheduled for launch in early April and will carry configuration C SAREX gear. Jay Apt N5QWL and Linda Godwin N5RAX are looking forward to their nine-day mission and amateur-radio operations. The orbit will be very low at 120 nautical miles, but the inclination of 57 degrees should cover a lot of territory in North America.

STS-65 is expected to carry ham

SAREX Configurations Component Requirements	Voice Packet SSTV **A**	Voice Packet **B**	Voice **C**	Voice Packet SSTV FSTV **D**
Antenna cavity	●	●	●	●
Antenna adapter plate	●	●	●	●
Transceiver and power adapter (one unit)	●	●	●	●
Adapter module	●	●	●	●
Recorder cable adapter	●	●	●	●
Crew Personal Recorder	●	●	●	●
Batteries	●	●	●	●
Headset	●	●	●	●
Sony camcorder (with two 8mm tapes)	●			●
Combination VCR/monitor (with two VHS tapes)	●			●
Scan converter	●			●
Packet module			●	
FSTV module				●
PGSC (not charged to SAREX if shared)	●		●	●
SAREX disks	●		●	●
Cables:				
Headset extension	●	●	●	●
Tape recorder	●	●	●	●
Sony camcorder	●			●
Combination VCR/monitor	●			●
Camcorder/monitor extension	●			●
Shuttle video	●			●
Transceiver	●		●	●
PGSC DC power (not charged to SAREX if shared)	●		●	●
Shuttle DC power (not charged to SAREX if shared)	●		●	●
PGSC RS232 (9-pin)	●		●	●
FSTV				●
Antenna cable	●	●	●	●
Motorola cable	●	●	●	●

Figure 1. Current configuration possibilities of SAREX.

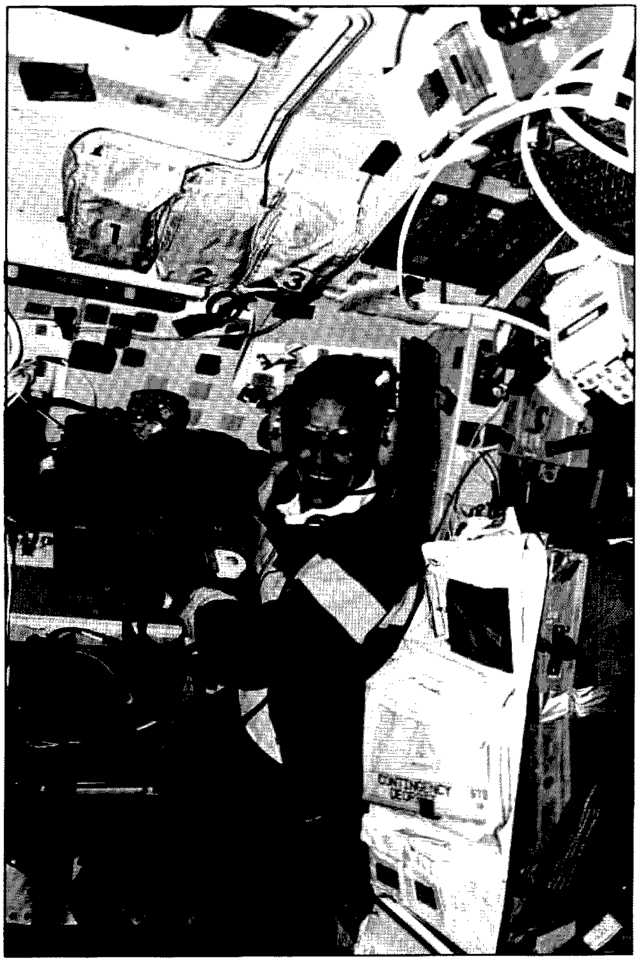


Photo C. Bill McArther KC5ACR with the packet gear on STS-58. (NASA photo.)

gear in July, once again with configuration C. The altitude will be 160 miles with a 39 degree inclination and should last 14 days. Due to the use of a side window for the antenna and the orientation of the spacecraft for this mission, the passes may be short due to shadowing of the antenna with respect to ground stations.

STS-64 is to be a September launch with configuration B SAREX gear. Power from the spacecraft for the ham gear is not currently available, so batteries will be taken. It is hoped that the situation will change before flight to allow power for packet operation and configuration C activity. The flight is set for nine days with an altitude of 140 miles and an inclination of 57 degrees.

More flights are expected for 1995, most with packet and voice, but a return of SSTV and even digital TV are being studied as possibilties.

The Future

What's ahead for SAREX? NASA's Principal Investigator for the program, Lou McFadin W5DID, believes that a permanent ham shack for the space station is the goal. Efforts are underway to coordinate a 2 meter FM rig with an outside antenna into the station's design. Anticipated Doppler shift precludes the use of higher frequencies, but all potentially useful systems will be considered.

Sample Conversation

W5RRR-1>SAREX [02/05/94 13:08:13] <UI>:
This is STS-60 SAREX Robot station W5RRR-1 onboard the Space Shuttle Discovery.
cmd:c w5rrr-1
*** CONNECTED to W5RRR-1 [02/05/94 21:08:52]
#926-is your STS-60 SAREX QSO number.
*** DISCONNECTED [02/05/94 21:08:56]
.
.
W5RRR-1>QST [02/05/94 22:40:43] <I S4 R0>:
Greetings from the crew of STS-60! Our current altitude is 190 nautical miles above the beautiful Earth that is the home for all of us. We are very busy with Spacehab experiments and hopefully today we will deploy the Wake Shield Facility
W5RRR-1>QRZ [02/05/94 22:42:07] <UI>:
#544-N6GIW K8SIN WB5UUK N7LQT N6YIE KE8GR KW7E KJ6HO GØERY KC8UD
N6VMS KØRI K7ZTM WB6GXX WA6LIE N8CLF KF6BM DL5KR KD6RJU W6GBF W6BME
WA5DJJ KR2C N7VWJ VE7ZR WA7DEO KD7LT N7INB AA7NI KB7WGC KB7ADO
W7TIZ N7KIO WA7QCC WB6FJE
W5RRR-1>QSL [02/05/94 22:42:08] <UI>:
DL5KR/976 KD6RJU/975 N7OFW/951 JH1DWU/948 JH3FDA/943 CO2VV/938
K4HVK/934 WA5ZIB/926 NØNTW/923 WA5NOM/922 NØULV/918 N7SFI/914
NØIYN/911 KB9E/908 9Y4DG/893
.
.
W5RRR-1>QRZ [02/06/94 21:33:33] <UI>:
#956-KI5UA NØSEG AB4EG KE7NS N7ZEF KDØGC KFØCT N9VDO NØULV KB7WAU
AAØHL K7RD NØIVN KB7WGC KV4KE KI7JM N7KMJ K7YCH N7UVF KB7QLY KW7Y
NL7OD VE7XQ AL7PB AL7BX WL7EF NL7RY WL7CX NL7RK AL7NO KL7GID KL7JAU
WL7EP JS1JIO JH4DHX
W5RRR-1>QSL [02/06/94 21:33:34] <UI>:
AL7BX/1634 WL7CX/1630 NL7VR/1628 WL7EP/1625 WL7CN/1623 JR4GMO/1613
JA2BGX/1612 JH2VHL/1609 KO4EI/1590 KB1SF/1584 N8BJN/1583 NL7ZL/1567
N9UDO/1547 WB2ELB/1530 KA9QFJ/1521
W5RRR-1>SAREX [02/06/94 21:33:34] <UI>:
This is STS-60 SAREX Robot station W5RRR-1
onboard the Space Shuttle Discovery.
W5RRR-1>WB5UUK [02/06/94 21:34:13] <UA>
W5RRR-1>WB5UUK [02/06/94 21:34:14] <I S0 R0>:
#1671-is your STS-60 SAREX QSO number.
W5RRR-1>QST [02/06/94 21:34:34] <I S3 R0>:

Hello from the crew of STS-60, Discovery! We've enjoyed several school contacts with students from Boise, ID, and Moscow, Russia, so far as well as a number of voice contacts at random. The views of the world from our orbit continue to be spectacular! We're working very hard with our mission control at present to get the Wake Shield Facility ready for deployment. We encountered problems communicating with it yesterday causing us to cancel the initially planned deploy.
The STS-60 Crew

Figure 2. Edited sampling of STS-60 packet operation.

RTTY LOOP

Number 16 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

The AEA CP-1

As has been evident by the several questions appearing in these pages over the last few months, interest in old equipment is far from over. In particular, the AEA CP-1 Computer Patch Interface has been the center of many a ham's efforts.

Introduced by AEA about 10 years ago, the CP-1 was one of the first RTTY modems; that is, modulators and demodulators, produced with the amateur computer station in mind. For its time, this was quite a unit. With a fixed 170 Hz shift and variable shift capability, it allowed just about any transceiver to operate on RTTY, with an appropriate software package. Originally, an interface option was available from AEA for adding an RS-232 port to the CP-1. However, sometime in late 1988 Texas Instruments ceased manufacturing two integrated circuits, the 75150 and 75152, which were the foundation of the interface. When the supply of these ICs ran out in early 1989, AEA was unable to continue sending an option kit for the RS-232 port.

Figure 1 shows a method for creating an RS-232 interface using a 1488 and 1489 integrated circuit (chips available at Radio Shack and many mail order distributors).

Referring to the diagram, U-1 is a 1488, U-2 is a 1489. All other designations, U-13 and U-12, refer to the silk-screened layout on the CP-1 printed circuit board. On the CP-1, resistors R-99 and R-100 must both be 1k ohm resistors. Ignore the values listed in the schematic. Those values in the schematic referred to the original design; the 1k ohm values work with the 1488 and 1489. Ground for U-1, pin 7, can be obtained at U-13, pin 8, the same place U-2 is grounded.

Now, NØCHP circulated another scheme last year, in which he says that the CP-1 can work on RTTY, CW, AMTOR, and even PACTOR with programs like HAMCOM, PCTOR, etc. However, AEA, in the original instructions for the RS-232 port using the 1488 and 1489, go a roundabout way. The following is much easier to wire up and understand:

Install JP 7, 10, and 3. Set JP 11 to +12 volts. *Now the difference:* On the CP-1 RS-232 port jump pins 5 & 20 (this sends modem output to pin 3 and takes data for transmission to pin 2). Jump pins 3 & 8 (this allows it to receive/transmit Baudot, ASCII, and AMTOR). Wire both ends of the RS-232 cable exactly the same, and do not wire any pins but these:

Pin 1	Frame ground
Pin 2	Send data
Pin 3	Receive data
Pin 4	Ready To Send
Pin 7	Ground
Pin 8	Carrier Detect

Now, if a Macintosh owner wants to try to use this, using a standard modem cable and appropriate software, it should work.

The CP-1 can be connected to a Commodore C-64 directly, as well, as shown in Figure 2. This uses the TTL levels available at the ports, so no modification to either unit is required. Once again, appropriate software in the C-64 to run RTTY would be required.

I hope these diagrams and directions will help get many of you up and running with a piece of equipment you have expressed an interest in. As noted, appropriate software in the host computer is essential. The "RTTY Loop" disk collection, as detailed previously, has several programs which may be of help. Additionally, a new Disk #5 is available, with some of the newest PC compatible programs around. As always, each collection may be yours for a disk, 3.5" 1.44 Mb preferred, self-addressed stamped return mailer, and $2 per disk, sent to me at the above address. Feel free to drop me a self-addressed, stamped envelope for a listing of programs, or send Email to me on CompuServe (ppn 75036,2501) or America Online (MarcWA3AJR) and I'll forward the list to you via Email. While I'm on Delphi as well (MarcWA3AJR), I have yet to forward a file via Email on that system.

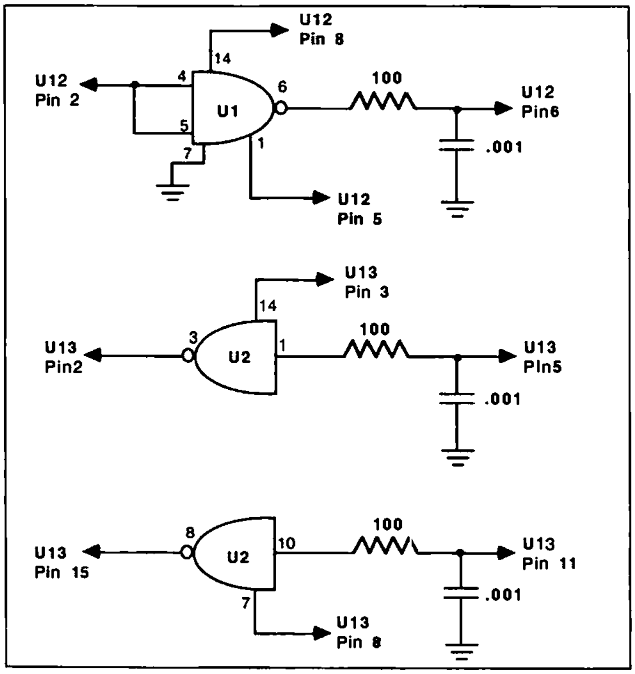
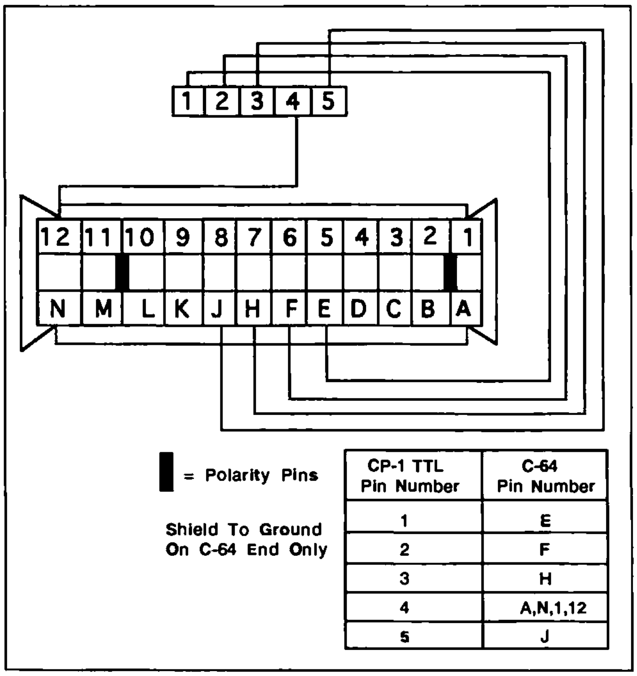


Figure 1. Method for creating an RS-232 interface using a 1488 and 1489 integrated circuit.



CP-1 TTL Pin Number	C-64 Pin Number
1	E
2	F
3	H
4	A,N,1,12
5	J

Figure 2.Connecting the CP-1 to a Commodore C-64 directly.

Number 17 on your Feedback card

CARR'S CORNER

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For Long Ham Equipment Life ... GET THE HEAT OUT!!!

Experienced electronics professionals know that heat is the great killer of electronic devices. Equipment that passes or delivers large amounts of either current or power must be kept cool for proper operation. The methods given in this month's column are simple, yet are sufficient for most applications. While reliability engineers and thermodynamicists will flinch at the lack of mathematical elegance in this approach, the methods are nonetheless effective for most practical ham radio applications.

There is only one simple rule: Where there is excessive heat, remove it.

But, as they say, "the devil is in the details." What does "excessive" mean? If the equipment feels too hot to the touch, or has a history of unexplained failures or repairs, then it is probably running too hot. An engineer will have specifications to meet and calculations to make, but they are beyond the scope of this column. The practical "takes off the skin of the thumb" rule suffices for our needs.

Consider some practical examples. I know of a medical central monitoring station in a hospital that once suffered from heat exhaustion. The monitoring console contained oscilloscopes that were slaved to bedside monitoring sets in the coronary care unit (CCU). The carpenter who built the console was a master craftsman in wood, but did not understand electronics worth a squat. He completely enclosed the monitor—a pretty nice installation, except that there was no ventilation. The service technicians in the hospital had to be summoned in the middle of the night, on the average of once a month. This was not only expensive, but it placed the patients at risk as well.

Another example was seen in consumer electronics servicing. A low-cost compact stereo unit from Japan was causing the importer fits because warranty returns were terrible. Shops were awash with returned units. Adding Insult to Injury, the repaired units often returned again before the original warranty expired. An enterprising technician began installing sheet metal heat sinks on the TO-5 audio output transistors (it was a relatively low-power unit), and his work didn't return. The service manager noted that fact, and issued a service guidance letter to all warranty stations ordering heat sinks installed on all units returned. Subsequent modifications from the manufacturer included heat-sinking.

There are three basic tactics which can be used in any combination to remove heat: 1) radiate more of the heat; 2) improve natural ventilation; or 3) add or increase forced-air cooling. Water cooling is not an issue for most hams, although some commercial broadcast transmitters and high-power industrial electronics devices use circulating water for cooling. (Some broadcasting stations use the waste heat from the transmitter's water radiator to heat the transmitter building).

Protecting Transistors & IC Voltage Regulators

Semiconductors are especially prone to heat damage, so manufacturers often take special care to rid solid-state circuits of heat. In both of the examples presented above the parts causing the problems were the semiconductors. In the case of the hi-fi gear it was obvious, but in the hospital case, analysis of the service records indicated that DC power supplies and cathode ray tube deflection amplifiers were the main printed wiring boards replaced. Further analysis by the manufacturer showed that it was primarily the voltage regulator transistors on the power supply, and the output amplifier transistors on the deflection circuits. Electronic reliability experts note that semiconductors should be operated such that the junction temperatures inside the transistors are kept at 110°C or less, even when rated at 125°C. According to one reliability handbook, the mean time between failure (MTBF) of semiconductors is cut in half for every 10°C increase in junction temperatures. Thus, even small improvements in the temperature situation can make a tremendous difference in the final product.

On some small equipment it is not practical (or possible) to use forced air cooling, so you will have to provide heat-sinking for the semiconductors. In fact, even in most forced-air cooled equipment the semiconductors will need these metal radiators. Figure 1a shows the metal TO-5 transistor package. Most of these transistors are mounted on printed wiring boards, and are low-signal (and low-heat) devices. But certain TO-5 transistors, such as the 2N3053, 2N5109 and certain 3 to 10 watt RF power transistors, operate at moderate power levels. A "top-hat" finned heat sink, such as that shown in Figure 1b, is mounted on the TO-5 package to radiate heat. There are also certain other "spring clip" versions of this same kind of heat sink.

Figure 2a shows two different plastic power device packages. You will find these packages in audio power transistors (e.g. 2N5249), thyristors and three-terminal IC voltage regulators. In the regulator case, the devices are usually rated at 750 mA in free air and 1,000 mA when heat-sinked. These devices are frequently used at higher power than they are rated for! Either vertical or horizontal finned sheet metal heat sinks, such as that shown in Figure 2b, are used to provide heat dissipation. Be sure to use a thin layer of silicone heat transfer grease between the metal tab surface on the transistor (or regulator) and the heat sink. Also be sure to tighten the mounting screw properly in order to fa-

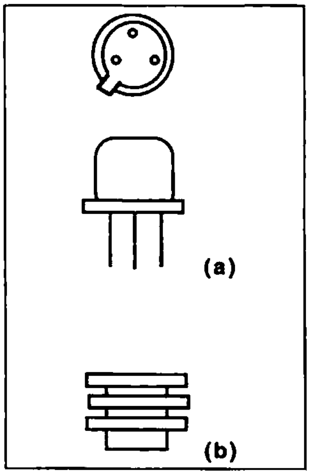

Figure 1. a) TO-5 transistor package; b) TO-5-style top-hat heat sink.

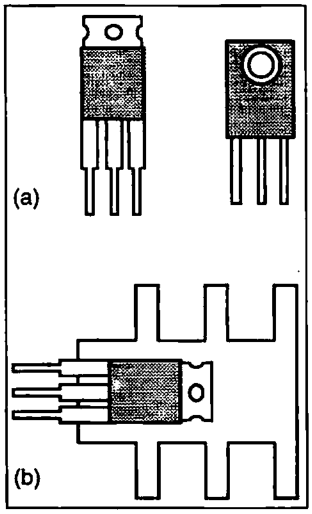

Figure 2. a) TO-220 and other plastic power transistor package; b) TO-220 device mounted to sheet metal heat sink.

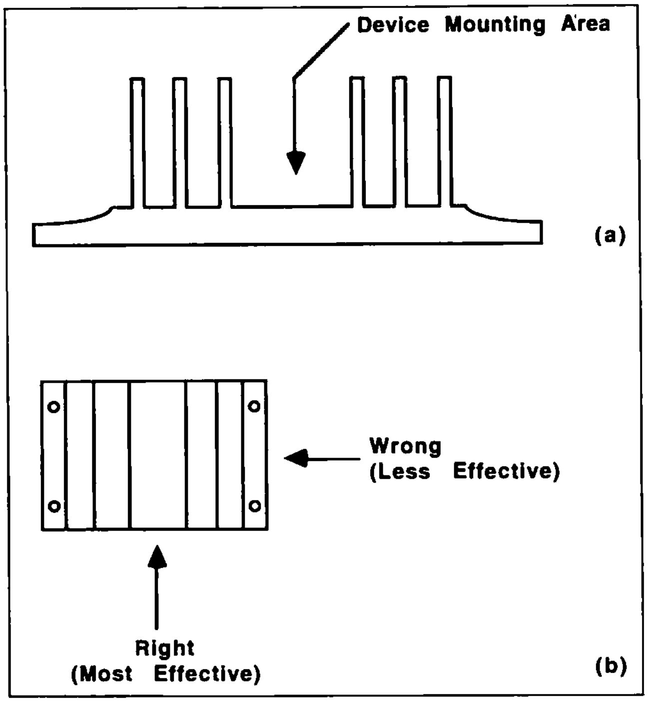

Figure 3. a) Power transistor heat sink; b) right and wrong ways to direct air at heat sink.

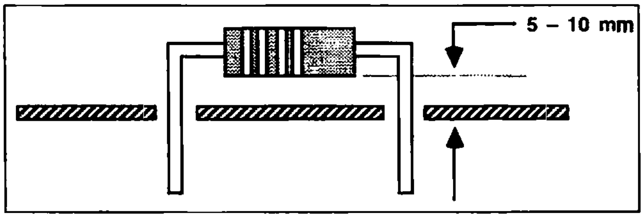

Figure 4. Power resistors (1 watt and up) should be mounted off the board surface.

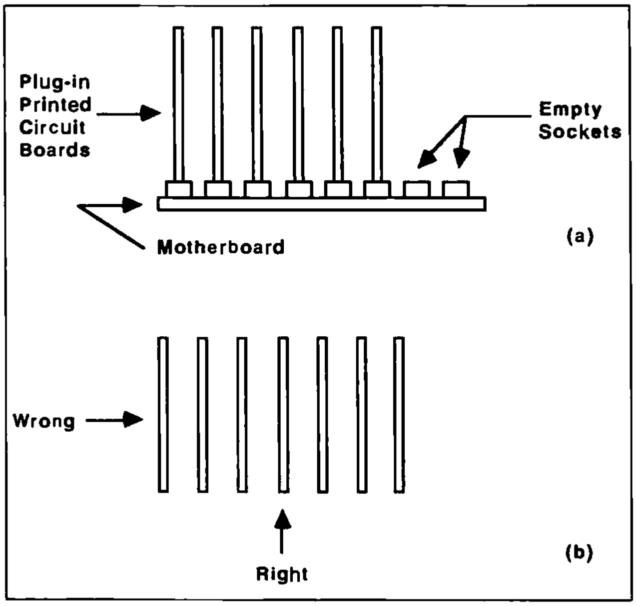

Figure 5. a) Several printed circuit cards mounted in sockets on a motherboard; b) right and wrong ways to direct air over the printed circuit cards.

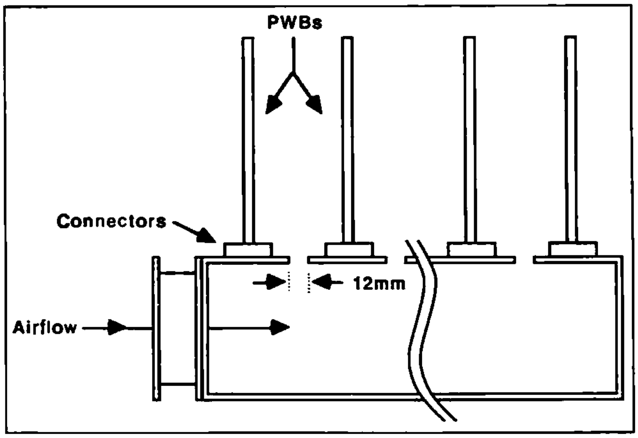

Figure 6. Holes in an otherwise closed chassis were used by one computer manufacturer to direct air over PWB surface.

cilitate heat transfer to the heat sink.

Sheet-metal heat sinks lor TO-3 transistors and three-terminal regulators are mounted on a printed circuit board. The bent sheet metal heat sinks are good lor up to about 10 watts of power, or voltage regulators up to 1.5 amperes. For the 3 ampere, 5 ampere and 10 ampere voltage regulators that also use a TO-3 package it would be better to use a larger finned heat sink.

In many pieces of equipment the metal chassis is used for heat-sinking. In those cases the transistors are bolted either directly to the metal chassis or mounted via mica insulators if electrical isolation is required. In both cases, silicone heat transfer grease is used between the semiconductor device and the chassis. This method is especially successful when the chassis is large, or when it is particularly thick (i.e. has a high "thermal mass").

Some printed wiring boards (PWB) use large areas of unetched copper foil and/or large metal ridges or blocks to provide better heat-sinking. This method is used especially where there are no single devices that can be individually heat-sinked (e.g. a TO-220 transistor), but rather a large number of heat-producing devices such as TTL ICs.

There are many different forms of large, finned heat sinks used for TO-3 (and other) transistors, high current voltage regulators and high-current diodes and SCRs; Figure 3a shows a side view of one of these heat sinks. In this case, the TO-3 transistor (or other device) is mounted with screws on the flat central surface of the heat sink. In most situations, it is wise to use a thin smear of silicone heat transfer grease

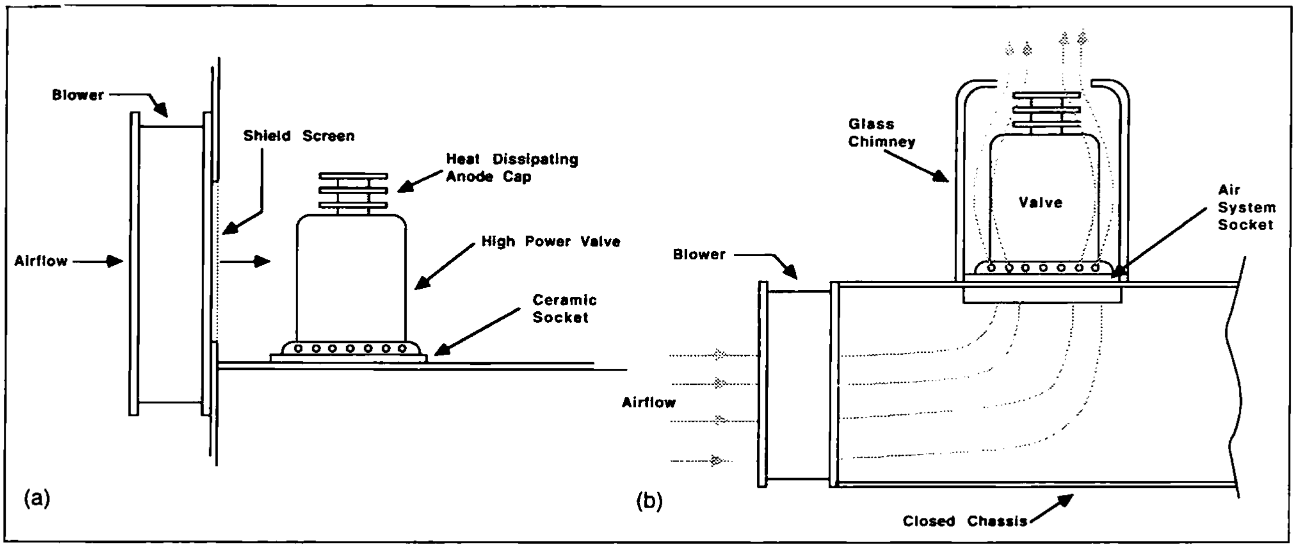

Figure 7. a) Direct method of cooling RF power tubes; b) use of an air system socket.

between the device and the heat sink. This grease is especially needed when a mica insulator is placed between the semiconductor device and the heat sink. Again it is necessary to make sure that the mounting screws are cinched down tight enough to allow maximum heat transfer (but not enough to distort the device package). The big issue in selecting a heat sink is the surface area.

When forced air is used to cool a heat sink—a good idea when the power and/or current is high—the orientation of the heat sink with respect to the airflow is sometimes important. Figure 3b shows the right and wrong ways to force air over the finned surfaces. Keep in mind, however, that orientation is not always critical, especially when air from the "wrong" direction is sufficient or blows over the entire surface. The designations "right" and "wrong" are merely general considerations for some critical applications.

Microprocessor chips are no different from other semiconductor devices: Heat kills them. To make matters worse, speed beyond the designer's specified speed often generates excessive heat inside the chip. Some low-priced computers operate cheaper lower-speed chips at a higher clock rate, but at the cost of decreased reliability. Even in well-designed computers, reliability improvement is possible by cooling the microprocessor chip.

Some 486 personal computers add a second fan on the back of the cabinet, in addition to the one in the DC

power supply, in order to cool the very high-speed chips on the motherboard. Other vendors offer a clip-on fan that mounts above the 486 chip and blows air on it directly. These fans are designed to rob power from one of the computer's disk drive power connectors. In the JDR Microdevices (2233 Samaritan Drive, San Jose CA 95124) catalog there is a "refrigeration" clip-on fan for 486 chips. I suspect that this device has a Peltier-effect solid-state refrigeration unit embedded in the fan block. Some vendors of computing stuff tell me that they won't sell a 486 machine rated at more than 33 MHz clock speed without installing the clip-on fan to cool the main chip.

Other Components

Certain components other than power transistors generate heat. Rectifier diodes, bridge rectifier stacks and power resistors are prime examples. How these components are handled is critical in determining the reliability of electronic *equipment*.

Rectifier diodes and power resistors should be mounted with their bodies 5 mm to 10 mm from the Printed Wiring Board (PWB). Please see Figure 4. This procedure allows the heat to dissipate into the air instead of into the PWB material. Many phenolic and some Fiberglas printed wiring boards can be badly damaged from the effects of a 10 watt power resistor mounted flush to the surface. Some "bargain basement" or "grab bag" rectifier diodes can meet their rated forward current only when the rectifier is a) mounted 10-15 mm off the board, and b) have the axial leads cut to 20 mm or longer. Those diodes are overrated and should either be used only in lower than the rated current applications or shunned entirely.

Besides reducing the operating life or limiting the power output of circuits, overheating can also decrease performance in other ways. Certain circuits, oscillators for example, are inherently sensitive to heat. There was once a popular two-way radio transceiver that suffered terrible frequency drift because the *master* oscillator was located right next to the RF/IF strip vacuum tubes. Although that was such a bad design error that nothing would really "fix" the situation, a lot of technicians improved the frequency stability markedly by adding some thermal insulating material between the RF/IF PWB and the aluminum oscillator shielded housing.

Large Multi-Board Equipment

Figure 5a shows a piece of typical large-scale multi-board equipment, such as a microcomputer, in which plug-in printed wiring boards are installed on a socketed motherboard. Usually, these PWBs will be mounted in a closed cabinet for both Electro-Magnetic Interference (EMI) and aesthetic reasons. If we apply air broadside to the PWBs, only the first one in the lineup will benefit. Figure 5b shows a top view that permits you to see right and wrong airflow directions. Obviously, air coming in from the sides is better able to remove heat from more of the PWBs.

Figure 6 shows a method that was used in a minicomputer a few years ago. There is a large metal chassis with a motherboard mounted on it to hold the PWBs. There were several 12 mm holes cut in both the chassis top and the motherboard to admit air between the boards. Although only one hole is shown between each board in this side view, there were four per row in the actual computer. Air from the blower flowed up through the holes and across the electronic components on the PWBs.

Radio frequency power amplifiers and high-power transmitters pose special heat problems. Some linear power amplifiers, for example, are only 45 percent efficient. Therefore, a 1,000 watt linear amplifier delivers 450 watts of usable RF power and 550 watts of waste heat. To make matters even worse, the necessity of keeping harmonics inside the transmitter means buttoning up all that heat inside of a shielded metal cabinet.

Most RF power amplifier tubes used in ham radio transmitters must be forced-air cooled in order to realize their full ratings. (Some are absolutely dependent on cooling.) Figure 7 shows two methods for providing the needed cooling air. In Figure 7a we see the situation where a blower is mounted so that the air flow is directly over the glass envelope. The fan may be mounted either exterior to the RF compartment (as shown) or inside.

The other method, shown in Figure 7b, assumes the use of "air system" tube sockets. A blower or fan supplies air to the bottom side of the socket, and the air is directed upwards through holes in the socket and around the glass envelope. A "chimney" aids in keeping the airflow against the glass. Some air system sockets have plumbing connections for the air hose, while others are dependent upon pressur-ization of the lower compartment. In either case, the reason this socket is better is that the lead seals in the glass are kept cooler. The plate cap lead seal should also be kept cool, if possible. Toward this end *some* builders use a finned "heat dissipating" plate cap to make electrical connection to the anode.

IC Printed Circuit Boards

The component density possible on modem printed wiring boards (PWB) makes it possible to make very small, high density products such as modern radio communications equipment and digital computers. Unfortunately, as the number of IC devices on a card increases, so does the problem of cooling them off. In some cases, impingement airflow, as discussed earlier, is neither feasible nor desirable, but we still have to remove the heat. One solution is shown in Figure 8. This method uses a ladder heat sink built onto the board.

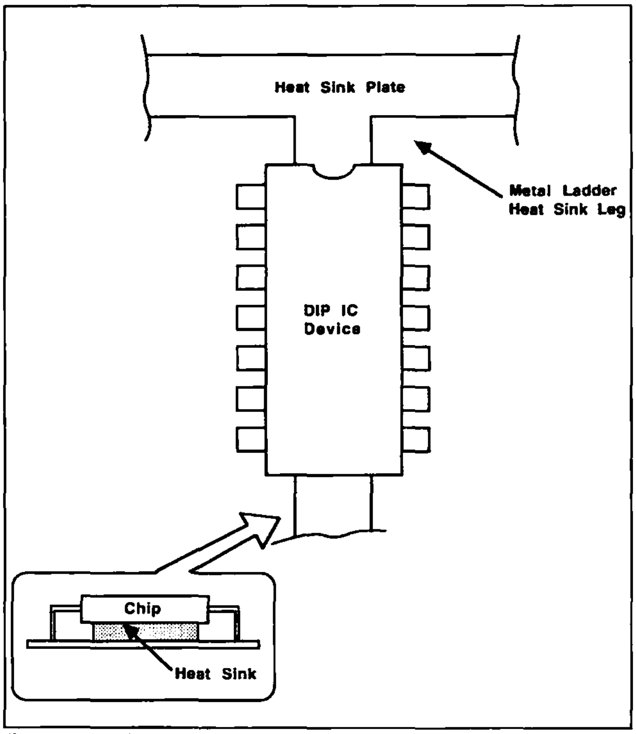

Figure 8. Use of a heat sink ladder network on a printed circuit board with a large number of ICs (particularly important in large TTL boards).

In Figure 8, a heavy metal "ladder" is run underneath each IC device (see inset) and is joined to a large heat sink bar on the card edge. Heat is removed from the IC area by conduction. In some cases, air flow can de directed across the card edge heat sinks. In this type of construction, we usually want to place the most heat producing components as close as possible to the edges of the PWB where the heat sink bar is located.

A neat trick used in some commercial and military equipment, although less practical for hobbyists, is to enclose the chamber containing the printed circuit board and use the conduction ladder method to conduct heat to the walls of the box (Figure 9). The box walls act as a "cold plate" to sink the heat. Forced air is blown through chambers on the outside of the cold plate to carry heat away.

Conclusion

Heat is clearly the great destroyer of electronic components. If a piece of equipment runs too hot the result will be erratic operation, frequent breakdowns and all the headaches that accompany low reliability. Although it is ordinarily unwise to modify equipment without expressly written instructions from the manufacturer, there are sometimes exceptions to this rule. An obviously overheating piece of equipment that can be modified with no adverse effect is a candidate for exception to the rule. The simple methods shown in this column will permit you to modify equipment to gain the longest and most reliable use. ■

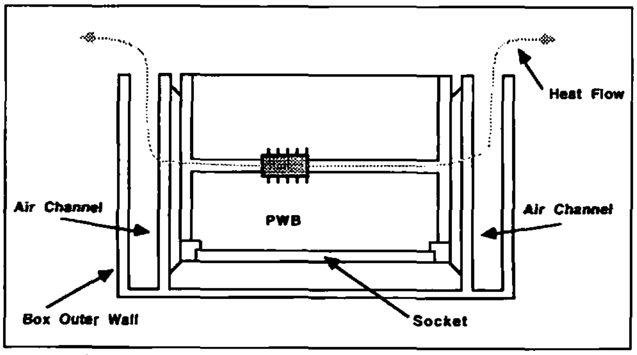

Figure 9. Closed box for mounting PWBs uses air channel and cold plate to carry away heat conducted from the printed circuit board.

Number 18 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
PO Box 2508
Fullerton CA 92633

T-Hunters to the Rescue

Last August 7 was a typical Saturday at the top of Skyline Drive In Fullerton. By 7:45 p.m. a dozen cars, trucks, and vans formed a row on the roadside. Unusual antennas—quads, yagis and dopplers—were mounted on top or through the windows of each.

I joined the circle of hams of all ages laughing and chatting, as another ham walked to each vehicle and wrote down its odometer reading. A radio direction finding (RDF) contest, called a foxhunt or T-hunt, would begin in 10 minutes. None of the hams knew where they would end up that evening, nor what they would find.

One team had broken away from the group. Bob Miller N6ZHZ and Cathy Livoni KD6CYG were removing their four-element 2 meter quad and substituting an eight-element UHF quad. Soon they would put on the blue jump suits that they keep close at hand. Bob had just been alerted by pager to the presence of an emergency beacon signal on 243 MHz.

When a pilot or a boater is in trouble, radio rescue devices bring help to the scene. Emergency Locator Transmitters (ELTs) for aircraft activate on impact to signal the location of a crash scene. Emergency Position-Indicating Radio Beacons (EPIRBs), which are manually activated by sailors in distress, share the ELT frequencies.

ELTs and EPIRBs transmit a distinctive tone to attract attention. Newer ones transmit digital registration data, too. But despite their names, they do not transmit the coordinates of their location, so they must be found using RDF techniques. As members of the Civil Air Patrol (CAP), Bob and Cathy are always on call to begin tracking when a beacon comes on the air in the Los Angeles metropolitan area.

CAP, an auxiliary of the US Air Force, is a non-profit organization of aviation-minded civilians from all walks of life. The California wing of CAP is responsible for tracking all on-shore ELT/EPIRB activations in the state and performs air/ground searches when crashes occur.

Civilian ELTs, some military aircraft ELTs, and most EPIRBs transmit on both 121.5 and 243.0 MHz. Other military aircraft and survival beacons emit only on 243.0 MHz. The newest EPIRBs transmit on 121.5 for 50 seconds, then send a short data burst on 406.025 MHz.

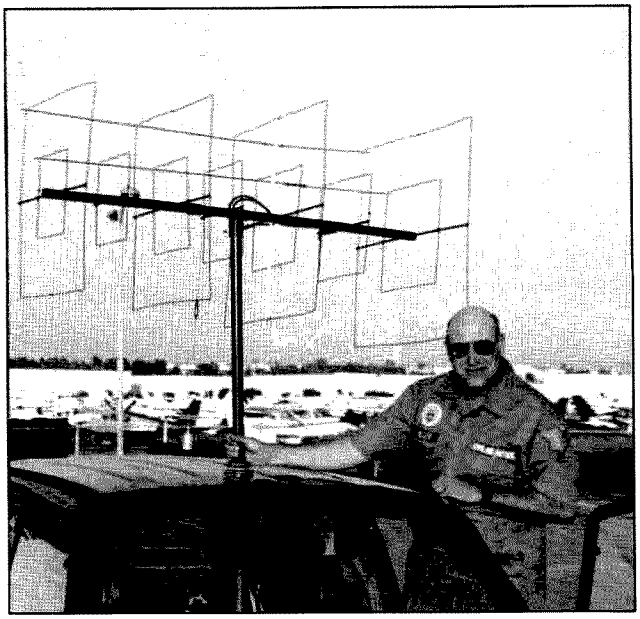

Photo A. Civil Air Patrol Captain Bob Miller N6ZHZ is testing his new dual-band mobile quad with four elements for 121.5 MHz and seven elements for 243.0 MHz. He is Commander of Brackett Composite Squadron 64 in La Verne, California.

A Sleepy Seaman

The next morning, as T-hunters rehashed their competition on a UHF repeater, Bob told the story of his and Cathy's evening. They had traced the

Photo B. Cathy Livoni KD6CYG publishes the official T-hunt calendar and hunt list for Southern California. She recently joined CAP and uses the Little L-Per to sniff out emergency beacon transmissions.

243 MHz signal to a home 17 miles from the hilltop, where a US Navy man was asleep on a couch with a personal EPIRB lying next to him.

"The sailor had found the beacon in an emergency provisions bag he had purchased from another sailor aboard ship," Bob announced. "He didn't know what it was. He had been playing with it and managed to turn it on. He was tired because of his long driving trip from port, so he put it down and went to sleep."

Whenever possible, pilots monitor ELT frequencies for rapid discovery of activations. Since the mid 1980s, however, most transmissions are detected by satellites in the SARSAT/COSPAS program. Three Russian COSPAS birds monitor 121.5 and 406.025 MHz. Three US SARSATS hear these frequencies, plus 243.0 MHz.

The low-orbit high-inclination tracks of SARSAT/COSPAS satellites put one over any given point on earth about every two hours. Doppler shifts of the downlinked beacon signals are computer-processed to determine their point of origin. Accuracy of the fixes varies from dead on to 20 miles off, depending on the signal quality and the satellite path.

Beacon signals received by satellites are relayed by downlinking terminals to SARSAT/COSPAS mission control centers. Coordinates of US "hits" are passed to the Rescue Coordination Center at Langley Force Base in Virginia, which in turn notifies the agency having jurisdiction. If it is the Civil Air Patrol, a local Mission Coordinator (MC) is assigned and volunteers are alerted by phone, radio, and pager.

Speedy RDF Saves Lives

CAP's Lt. Col. Pat Robinson WA6OIS began tracking ELTs when they were first mandated for aircraft in 1972. Since that time, she has discovered three unreported crashes. As we talked, her dog Jody tugged continuously on her leash. "I first got a search dog after we accidentally walked by a crash at night in the Santa Ana mountains," she told me. "We smelled the smoke but thought it was coming from a campfire below us."

There are over 4,000 dues-paying CAP members in California, but only a few are RDF experts. Pat, Bob, and Cathy are dispatched to find about 90 percent of the activated ELTs and EPIRBs in the Los Angeles basin each year, coordinating their searches on one or more of the seven Southern California CAP repeaters just outside the 2 meter ham band. They say that 98 percent of the reported beacon transmissions are accidental, not calls for help.

According to Pat, "We have found activated ELTs and EPIRBs in almost any place you can imagine, including a dumpster in Costa Mesa, a junkyard in Oxnard, a UPS container on an incoming train, and even in one of our own CAP planes. One night I was involved in turning off an ELT on an L-1011 at Ontario airport. It was being delivered to an Arab oil baron the next day, with $17M worth of modifications. The bathroom had gold fixtures."

"Occasionally I go as long as a month without a call, but sometimes I get three in a day," Bob says. "They bunch up in bad weather. It seems like I have found half my ELTs in the rain. Often water leaks into a plane and causes a short across the power switch. These are the hardest to find because they have marginal signal, often with no

modulation. They may be intermittent, disappearing after the rain stops."

Since many false ELT activations occur in hangars, CAP has convinced some airports to buy their own RDF sets, so that when ELTs are reported, airport personnel can secure them quickly. Harbormasters have not done this, however. "I've done more hunting of EPIRBs lately than ELTs," says N6ZHZ. "I've found them in vessels of every size, even in a jet ski!

"One day, after the Coast Guard had been searching unsuccessfully for an EPIRB, CAP was called for assistance. I went to the harbor where there was a helo circling, trying unsuccessfully to DF the unit. After a few minutes, I found it. It was on one of the Coast Guard's own cutters!"

WA6OIS tells of tracking a signal to a vessel at the Wilmington boatyard. "It had barnacles all over everything, including the glass, and it smelled to high heaven. The EPIRB was inside the cabin. The boat had sunk, staying under 60 feet of water for four months without the device activating. After they pulled it up and the water drained out, the EPIRB tipped over and turned on. We switched it off and left a note on it. The next day we were called out and ended up finding the same beacon, moving this time. Someone had found it and was taking it home in a truck."

Any signal on 121.5 or 243 MHz can interfere with the sensitive satellite tracking system. FCC regulations call for shielding of computers and other devices that can emit RF on these frequencies. Your local cable company cannot use channels containing ELT/EPIRB frequencies unless it can demonstrate adequate system shielding.

CAP RDFers frequently have to track down such sources of QRM. "It doesn't take a lot of RF to key some of the satellites," Bob says. "We turned off an interfering word processor one evening. I got a call the following morning from the MC saying that it was back on. I went back to find out that it was still off. The signal was coming from an identical model in the office next door. I looked at the serial numbers on the two and they were consecutive."

Don't Mess With These T-Hunters

Persons who accidentally activate ELT/EPIRBs or create interference on their frequencies must immediately cease their emissions when notified or face prosecution. "Most people are cooperative," says Pat, "although one man threatened to shoot us."

CAP's beacon searchers can get prompt backup from the authorities when necessary. N6ZHZ had to overcome resistance from the employees and night manager of a telephone company repair center. "He refused to turn the offending piece of test equipment off," says Bob. "I had the Mission Coordinator call him, and he rudely told the MC to 'go pound sand.'" So the MC had an Air Force Colonel call to politely explain the situation. Again, he didn't recognize anybody as having jurisdiction to tell him to turn off his test equipment, and he used four-letter words to say so.

"So the Air Force had the FCC and a US Federal Marshall go out the following morning with a search warrant. They arrested the facility manager as he came in, arrested the night manager

Photo C. With over 20 years of experience, search and rescue volunteer Pat Robinson WA6OIS is quick to embrace new technologies such as satellite navigation units. CAP makes extensive use of these devices to pinpoint crash locations.

who had given them a hard time, and seized the offending equipment. It went to court, and based on my written statements and deposition, the night manager ended up with a 2-1/2-year prison sentence, which was commuted to probation. They fined the phone company $10,000, and the facility manager was fined, too."

N6ZHZ credits ham radio with helping him develop his RDF expertise. He began T-hunting three years ago. "I couldn't find anybody to train me in the CAP," he says. "Then I got into amateur radio and met the Southern California T-hunters. It didn't take long before I was hooked."

But beacon hunting is quite different from foxhunting. "On a mobile mileage hunt, you get a comforting level of signal at the starting point," says Bob. "There's not a real sense of urgency to go get it. Whereas with the ELT, you often start out without hearing the signal and wondering when you'll be able to."

When his beeper sounds off, Bob knows lives may be at stake. "There's more of an adrenaline rush hunting ELTs," he says. "But the same skills apply. The hardest thing for me to do is bounce back and forth. In ham T-hunting, teams don't share information. The rule is—no clues! In CAP, the object of the game is to share signal strength and bearing info, and try to get somebody to find the transmitter as rapidly as possible. It takes a change of mindset."

Searching on foot for a signal at close range is sometimes called "sniffing" by ham foxhunters. Bob says his sniffing skills get a real workout in CAP searches. One night he tracked a 121.5 MHz signal to a storage room in an airline's repair facility at Los Angeles International Airport. Inside were 800 ELTs! Which one was transmitting? Bob's sniffing equipment led him to a corner of the room, where a box of beacons had accidentally been placed on the power switch of one ELT, turning it on.

L-Pers Versus Quads

The Little L-Per by L-Tronics of Santa Barbara, California, has become the de facto standard RDF set for beacon tracking. It has two vertical dipoles on a wooden frame, plus a sensitive receiver. In the DF mode, the dipoles are switched rapidly between two cardioid patterns, giving a sharp left-right directional indication on the panel meter.

Operation of the L-Per appears the same as Time-Difference-Of-Arrival sets described in previous "Homing In" installments, but its design principle and circuitry is quite different. Whereas TDOA units work only with FM receivers, the L-Per uses AM detection for optimum performance in the AM aircraft bands. Many hams use L-Pers for foxhunt sniffing, but the receiver's four crystal-controlled channels limit its versatility on ham bands.

Like many other CAP RDFers, Pat uses a pair of mobile whips with her L-Per when driving. Her dash-mounted indicator tells whether the signal is left or right and includes a signal-strength meter. "I can't turn the antenna," she says, "so I turn the vehicle. In the city, if it's off to the right, I turn right, go to the next street and see where it goes from there. L-Tronics recommends a second set of antennas to indicate fore and aft, but I like it this way. I can make a big circle and point right to the target. I can almost pick out the exact plane from across an air field."

Bob wants CAP to add high-gain antennas like quads and yagis to the equipment pool. "My quad has a lot more gain," he says. "And you can add it to the L-per receiver for very high sensitivity and increased range. I can rotate the quad and not have to turn the car to get a precise heading. I can twist the boom to horizontal polarization to reduce re-radiated signals from airport antennas and structures. My biggest problem is convincing people to drill holes in the roofs of their cars.

"With the quad, I am able to pick up a 243 MHz ELT two to five miles miles before the L-Per's antenna will hear it. When there are two or three ELTs chirping simultaneously in hangers at an airport, I can use a high-gain quad to track one at a time, listening to the differences in tone sweep rate of each one."

Help Wanted: T-Hunters Please Apply

The Patrol needs more RDFers and search/rescue volunteers, especially in Florida and California, where the most ELTs and EPIRBs are registered. "Here in California, we do the most search flying of any state," boasts Pat. "We go out in all kinds of weather."

"We cover a wide variety of rugged terrain, from coastline to mountains to flat desert," Bob adds. "So we have strict membership qualification requirements and a thorough training program, plus regular exercises. We can't go out to look for a pilot and then have to turn around and rescue our own."

Men and women over 18 years of age can become full CAP members. Boys and girls over 13 who have completed sixth grade are eligible to be CAP cadets. CAP provides vehicles, aircraft, and RDF gear for searches and training. But the most active searchers eventually buy their own, to ensure reliability and instant availability.

A tip of the hat to these three hams, plus all others who are using ham radio techniques to help save lives. If you want to learn foxhunting techniques and participate in an important public service, CAP can use you. If you win lots of T-hunts and are willing to respond to phone calls in the wee hours, CAP needs you. Inquire at your nearest airport to find out about local CAP RDF activity. If that doesn't work, contact CAP National Headquarters at Maxwell Air Force Base, Alabama 36112. The phone number for CAP Personnel Center is (205) 593-5463.

Number 19 on your Feedback card

HAMS WITH CLASS

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Remembering the Forgotten Art of Memory

In a recent graduate course I was taking, the professor asked how many of us thought that memory could be improved by exercising it—that is, to memorize dates, poetry, and so on. Then he asked how many of us thought that, like certain genetic traits such as eye color, you can't do anything about improving your memory.

The answer, according to the latest psychological research, is neither. Memory isn't a muscle, so exercise doesn't make it stronger. Yet, according to my professor and others who research the vagaries of human memory, there are things you can do to improve your memory.

As a teacher of ham radio, I of course have many situations where I have to tell the kids to simply memorize something. In my opinion, memory strategy is a very important skill to teach. Good memory skills can enhance the learning of "higher order" skills such as comprehension and critical thinking. Memory skills can help children master the basics so they have the tools to build on for higher-level concepts. I am always amazed at how many children are lacking in the simplest of organized methods of how to retain and then retrieve wanted data. Because so little emphasis is placed on this skill by most teachers, the kids really seem to enjoy the lessons I do on memory techniques. Now if I can only remember what they are so I can share them with you.

Any of the following seven steps can be adapted or modified to fit the appropriate age and ability group you're working with. In my experience, adults as well enjoy getting a refresher course in memorization techniques.

1. *Chunking.* This means grouping several items into one piece that's as easy to remember as a single item. We recall an acronym like UNICEF as a single name, not as six letters. Many students already know about using the word "HOMES" to prompt the recall of the Great Lakes: Huron, Ontario, Michigan, Erie and Superior.

Psychologist Laird Cermak, author of *Improving Your Memory,* urges us to make up our own chunks. His example: For a picnic, you need milk, soda, beer, salami, bologna, hamburger, napkins, paper cups and paper plates. That's a lot to remember, but you can make it easy. There are three drinks, three meats, and three paper goods. Use the first letter of each category—d,m,p—to make a word: damp (bad for picnics). Remember that, and you'll recall the categories, and then the items in each.

2. *External memory.* This refers to all physical devices that help you remember: lists, memos, diaries, and alarm clocks. When all else fails, there's always a deliberately misplaced object like a string around your finger to jog your memory.

3. *Associations.* Visual images are one effective form of association. To remember names, think of a visual link between a person's name and some facial feature, or think of a word you can make a visual association with that is a sound-alike for the person's name. You just met Jim Purdy who has a radio you'd like to buy. Think: I'll feel purty bad if I can't get the radio from Jim.

4. *Reliving the moment.* Studies have shown that sensory impressions are associated in memory to what we're learning, and later help remind us of what we've learned. If you're trying to recall a name or a fact, picture the place in which you learned it, the people around you at the time, or how you were feeling. If you're trying to remember where you lost something, mentally retrace your steps. Many students remember the names of ham radio guests I invite to class by recalling what part they personally played in the person's demonstration. Students always have a better chance of remembering an experience they've actually participated in.

Photo A. Children remember better when they actively participate in demonstrations.

5. *Mnemonic pegboards.* We've all seen performers who remember scores of names called out by people in the audience. They don't have unusual memories; they've previously memorized a set of words or images to which they mentally attach the names. It's easy. First, memorize these 10 "pegwords." They rhyme with the numbers one to 10: one-bun; two-shoe; three-tree; four-door; five-hive; six-sticks; seven-heaven; eight-gate; nine-line; ten-hen. Now make up a list of 10 other words and number them. Link each one to the pegword with the same number by means of an image. If your first word is license, picture eating a bun while you study from your license book. If your second word is radio, picture your shoe on top of your radio.

6. *Mediation.* This means attaching the items of a list to some easily-remembered "mediating" device, such as the jingle most of us use to recall the lengths of the months: " 30 days hath September . . . " Making up your own mediators can be fun, especially when you do it with the kids in a classroom. Before leaving for Christmas vacation we made up a list of items to take care of in our classroom. We listed on the board: give out plants to children, lock up the radio and other ham gear from our shack, make sure the ham radio telephone answering machine was turned on, lower the thermostat in the room, secure the windows, bag all the garbage from our class party, lock the door with the foxlock where the radio is kept. From the first letter of each item comes the silly sentence: "Peter Rabbit takes Tums with gourmet dinners."

7. Weaving it into the web. All of the above methods are useful for recalling simple lists and names. But with more complicated information, you can't merely memorize; you have to connect it to the many related items you already know. According to psychologists, that is the best way to retrieve it later.

Now you've got seven ways to teach kids how to increase their memory power. If only you could remember them all!

Don't forget to be on the lookout for articulate youngsters who would like to be guest speakers at the Dayton Youth Forum. Please have them contact me at (718) 983-1416, or write to P.O. Box 131646, Staten Island NY 10313-0006.

HAM HELP

Number 20 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I am trying to help a local neighborhood crime watch group that is in need ol CB radios/scanners for their crime patrols. Any type accepted: 23 channel, xtal, minor repairable, etc. Please help fight the crime that is taking over our neighborhoods, by donating those radios you no longer use. THANKS! *Rob Bellville N1NTE, P.O. Box 892, Northboro MA 01532-0892.*

I have an ICIR ASTRO 200A HF Transceiver. I Need the Instruction or Service Manual. I will cover the copy fee, or will copy it and return the manuals. I heard that the radio might have been bought by Swan and continued for a time. *John Przychocki, 115 Montague St., Brooklyn, NY 11201-3457.*

I need information on how to set up a YAESU FT-726 to tune the receiver or transmitter above and below 2 meters, 6 meters and HF Conv. ranges. Does anyone have any modifications? *N8ZAW, PJ, P.O. Box 32, Xenia OH 45385.*

I would like to purchase TTL connectors for the emerging ham population of Slovakia. Please contact me with the price, or with the names of Commodore clubs. (The C-64 is popular in Slovakia.) *Paul Taylor OM9AAK, 1 Penfield Ave., Croton-on-Hudson NY 10520.*

WANTED: Schematic and/or manual for a SILTRONICS 1011D. Vintage approx. 1976. 11 meter RCV, 28.5 to 29.0 MHz SSB XCV. I'll pay for copies and postage. Thanks. *Ron Gardin KB8KOV, 3297 West 94th St., Cleveland OH 44102-4855. Tel: (216) 961-1879.*

WANTED: Operating Manual for KENWOOD TR2400 2 meter transceiver. Will pay copy costs. *E. Danielezyk K9SXU, 9 Lloyd St., Cary IL 60013.*

QRP

Number 21 on your Feedback card

Low Power Operation

Mike Bryce WB8VGE
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While doing a review on the Howes transceiver kits, I found they lacked even the simplest T/R switching—it's done manually with a front-panel-mounted switch. The lack of a sidetone also proved frustrating to me. The kit did have a module for RF sensed sidetone generation, but that required a second speaker; one speaker (or headphone) for the receiver and another for the sidetone. I toyed with the idea of using a pair of stereo headphones—one side for sidetone, the other for receive audio. I trashed this idea based solely on my experience with stereo headphones and amateur receivers.

Stereo headphones have an audio response much too wide for pleasant listening. A 10 kHz beat note can really be appreciated after hearing it through a quality stereo headset. Reducing the audio bandwidth is especially important with a direct conversion receiver.

So, to fix both problems, I built up the circuit shown in Figure 1. It's a combination QSK module with sidetone generator. It also has a reed relay for keying the emitter lead of the driver transistor used in the Howes transmitter. Today's electronic keyers normally use a transistor pulling the key line to ground. This method works very well . . . most of the time. But, the emitter-collector junction, with its 0.7 volt drop, will not pull the key line all the way to ground. This may cause trouble when keying a rig using emitter keying, such as in the Howes transceiver.

Another drawback with the Howes system of T/R control is the ability to key the transmitter without switching the antennas. This could destroy the PA transistor in the transmitter, or cook the receiver. My QSK module prevents this from happening.

The QSK Module

A multi-pole relay does the switching between the receiver and the transmitter. The relay switches antennas, grounds the receiver's front end, and has several contacts left over for other tasks.

The reed relay keys the transmitter while the sidetone is injected into the receiver's audio chain. You can adjust the delay between transmit and receive with a front panel control. This control replaces the manual T/R switch on the transceiver. It's possible to get full QSK, if you don't mind the clicking of the main relay as you key.

In our bells and whistles department, a red LED glows when the module goes into transmit mode. I installed this LED behind the translucent face of the meter. It looks nice and, best of all, you don't have to drill any more holes in the front of the rig.

How It Works

A stable +5 volt reference voltage is supplied by U3, a 7805 regulator. A small load is placed on the 7805 by R15. This helps keep the regulator stable. One section of an LM324 is used to buffer the output of the regulator. In a circuit like this, the use of a buffer for the reference is overkill, but since the amplifier was available, I took advantage of it. The +5 volt reference is used by the delay circuit. Capacitors C6 through C8 are required to ensure stability. The entire QSK module is protected from reverse polarity by D1, a 1N4002 diode.

The QSK module is keyed by grounding the junction of R1 and R2. Normally, this junction is 3 volts. Resistor R3 and C1 help to remove any noise on the key line. Amplifier U1A buffers this key line before sending it out. The output of U1A is normally high. Keying the QSK module pulls the junction of R1 and R2 to ground. The result is a low at U1A's output.

With U1A output sitting high (unkeyed), it goes to three different subcircuits: sidetone generator, delay driver, and transmitter keying. The sidetone generator is a 555 timer (what else?) and is kept off by Q2. This keeps the timer's reset pin held to ground. When the QSK module is keyed, Q2 turns off, allowing the timer's reset pin to go high. The resulting output of the 555 is filtered by R15, R16 and C9. This filter clips off the edges of the square wave to make it easier to listen to. DC blocking is provided by C10. The output level is set by trimmer R17. The resulting 800 Hz tone is fed to the receiver board via the center terminal of the volume control.

The delay circuit takes the high from U1A and compares it to the reference voltage. When the QSK module is unkeyed, U1C outputs a high, charging up C4 via D2. This output is compared against the reference voltage by U1D. As long as the input is higher than the reference Q3 remains off.

Keying the QSK module changes things. U1C turns off, and C4 begins to discharge via R8 and R9, the delay control. When the charge on C4 is lower than the reference on U1D pin 13, it outputs a high turning on Q3, a power MOSFET. The relay then closes and the antennas switch. Diode D4 protects Q3 from the EMF caused by the relay coil's collapse.

Transistor Q4 inverts the output of U1A. With Q4 on, Q1 is turned off. When Q4 goes off, Q1 turns on and keys the rig via the contacts of the reed relay. Transistors Q4 and Q1 follow the keying at the R1, R2 junction. The reed relay provides a direct-to-ground keying for the Howes transmitter.

Construction

Although when first looking at the schematic the QSK module seems complicated, in fact it's really two ICs and some transistors. You could use fewer components, but I think you'll get sloppier operation, too.

This module is built on a piece of copper-clad perf board available from Radio Shack. The circuit is simple, so no PC board is available. If you're so inclined, lay one out if you wish. The relay is mounted on its side using a piece of double-sided tape. Diode D4 is mounted across the coil pins and not on the perf board. I used IC sockets for the LM324 and the 555 timer chip.

I placed the LED inside an LED lens before I glued the combination to the back of the meter's face with a drop of super glue. The lens does little to make the LED brighter, but its flat face makes the glue hold better.

It's best to build this circuit and test as you go. Testing as you go when building on perf board can make troubleshooting easier. The reference voltage source would be the first to go on the perf board, followed by the delay, sidetone and finally the keying components.

After assembly, test the module out before you install it in your transceiver. I left the connections between the antenna, receiver and transmitter up to you. It's simple to do. Using miniature coax, solder directly to the pins on the relay. I pre-assembled the coax before I mounted the QSK module inside the Howes transceiver. The QSK module had to be mounted on the bottom of the chassis. The 50k pot came with the kit and is placed in the front panel hole meant for the T/R switch.

Final Notes

If you have more than $10 in this project, you've spent too much money. The project has junk box priority! You can substitute parts without much concern. You don't have to use a 7805 either. A 78LO05 is fine, any 5 volt regulator would work as well. Why, a zener diode and resistor may work, too.

The 50k delay control is way too low in value for proper use. Capacitor C4 had to be a rather large value to allow enough delay. Why use the 50k pot to begin with? It was a leftover from the Howes transceiver kit. A 470k pot and 22 µF cap for C4 would be a good starting point if you want to experiment.

Although this project began as a fix to the manual T/R switching in the Howes transceiver, there is no reason why you can't use the basic module in your own QRP transceiver. It sure is simple, cheap and packs a lot of features for the money. 73

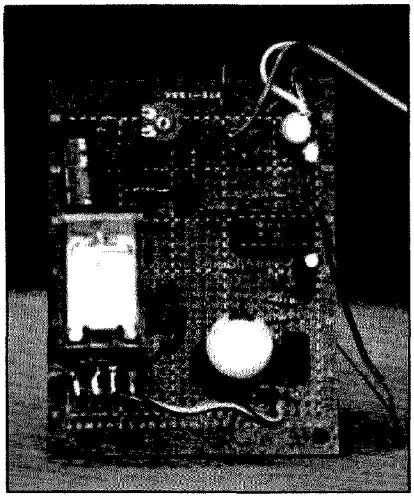

Photo A. The T/R controller is built on a small piece of perf board. The relay is mounted so its contacts are toward the edge of the board.

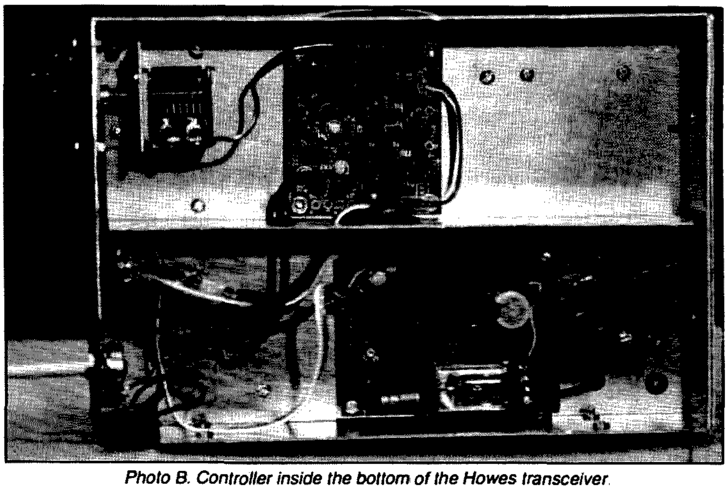

Photo B. Controller inside the bottom of the Howes transceiver.

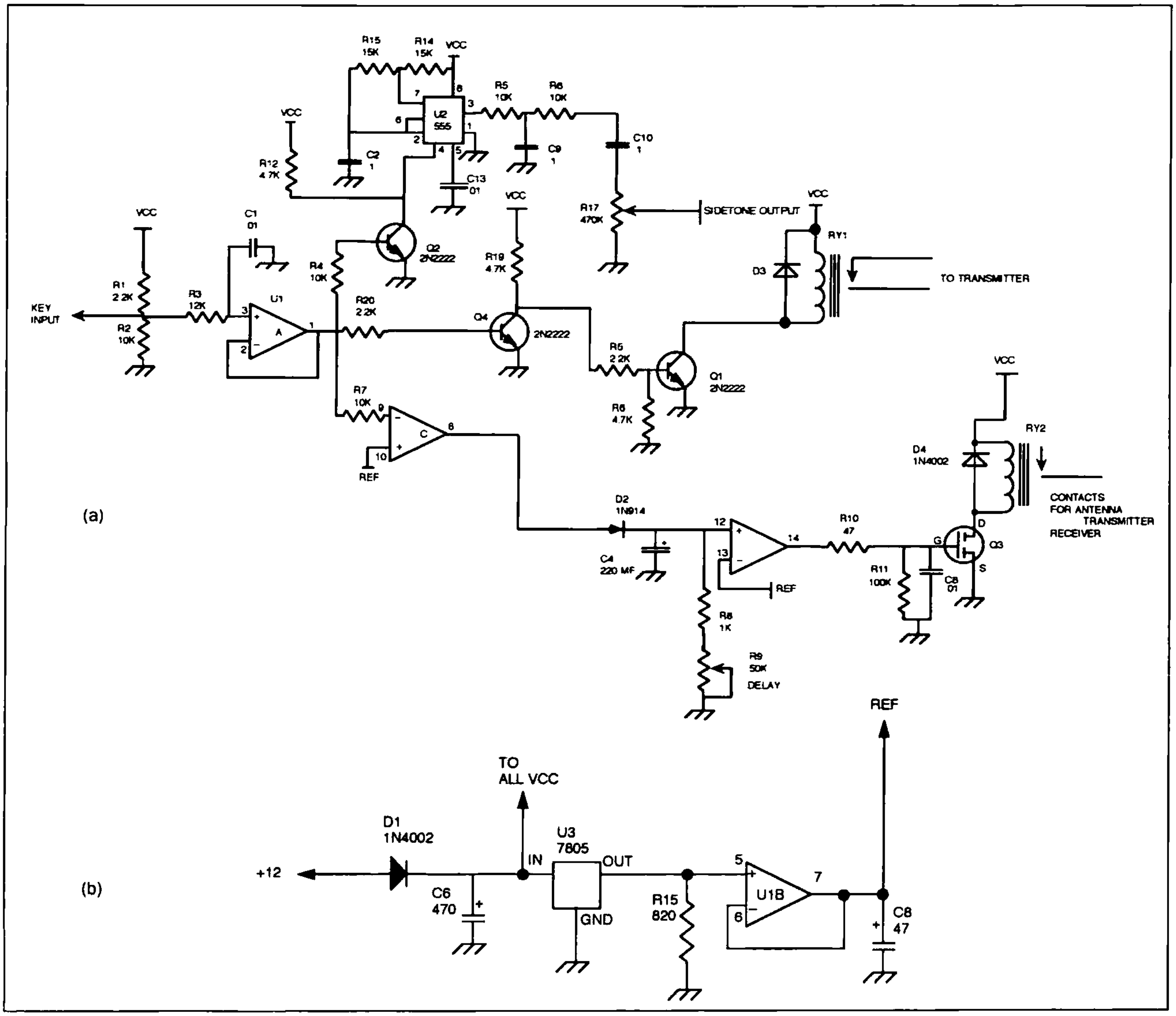

Figure 1. Schematic for the (a) QSK module and (b) reference voltage regulator/buffer circuits.

Number 22 on your Feedback card

PACKET & COMPUTERS

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What Are We Doing Here?

As you saw in last month's column, I was attacked by the oriental death flu. Well, I am back to about 90% capacity and I'd like to use this month's column to talk a little about JNOS, and some other things. First, last month's column included an example of an AUTOEXEC.NOS file from a working station. It should get you well on the way to a working station with just a little editing. Also included last month was a table describing how to give users permission to access various functions of your JNOS station. In both cases, there are some version-dependent differences—you'll need to sort out what is up with your station by reading error messages and observing behavior.

Catching Up

Many of you may be reading this column for the first time and have no clue what the first paragraph of this column is about. For you, let's take a quick look at what has been going on here for the past few months. Amateur packet radio is usually thought of as AX.25—Amateur X.25. This is a version of the X.25 protocol used in hard-wired networking adapted to use on radio channels. This protocol was developed quite some time ago—as ham radio technology goes—and was made possible for the average amateur by the TAPR TNC1. TAPR is a group of amateurs in Tucson who decided to develop the hardware to make amateur packet radio a reality.

The TNC1 was the first hardware and firmware system that understood AX.25. It was, in effect, a dedicated computer system-which could be connected to a "dumb" terminal and radio. With this equipment, amateurs could communicate via VHF radio circuits for a reasonable cost. What made packet special? Well, unlike ASCII (a form of Radio Teletype, or RTTY), which had been used on these same frequencies in the past, packet had one big advantage-error detection and correction.

With ASCII transmissions, any irregularity in the signal—noise, poor propagation, interfering transmissions—would cause data loss. The result was usually garbled nonsense and the operator would have to ask for a retransmission. Packet, on the other hand, is always error-free from the operator's point of view. This is because packet radio is based on data "packets," technically called frames, which are managed with an error-detection and correction protocol. In a packet radio QSO, each transmission is broken up into these frames and transmitted along with a "checksum"—a number generated by running an algorithm (set of mathematical operations) against the data in the frame. When the receiving station gets the frame, it runs its own, identical checksum. If they match, the frame is undamaged—if not, the protocol offers a way to ask for a retransmission. In any case, the operator never sees anything but perfect data (though it may take some time).

All this protocol stuff happens in that TNC—now a TNC2—and it talks through an RS-232 port to a terminal, today usually a computer running a communications program. This arrangement was much better than the previous digital modes, and it was quickly adopted. It soon became clear that a bunch of hams running stations with dumb terminals or terminal-emulator software was just not going to cut it. If packet radio was going to live up to its potential, something else was needed.

Hank WØRLI decided that some sort of host system was needed. Something that could store and forward messages and bulletins. WØRLI PBBS (Packet Bulletin Board Systems) soon became the de facto standard for the store and forward systems, and networks with PBBSs appeared all over the country. Today, there are many PBBS packages out there. All of them work hard to interoperate, but the standards involved are more of a gentleman's agreement than the law. Still, all things considered, the packet network works very well.

The problem is that PBBS software expects ordinary AX.25 connections and acts as if the connected station is a terminal. There is nothing inherently wrong with this, and this sort of access will be needed for a long time, since many users will only have a dumb terminal available. On the other hand, many hams are running sophisticated computer systems capable of being PBBSs themselves. These users then run a terminal program which turns their powerful system into a dumb terminal—what a waste!

The Other Possibility

There is a system which runs beautifully over amateur radio and takes advantage of the computer in the shack. It is based on an internationally recognized set of standards, and in the right location can let you literally

connect to nearly anywhere in Europe and many other places in the world with 5W. When I say connect, I am talking about real-time keyboard-to-keyboard connections.

This system includes utilities that will allow you to compose mail on your own machine and have it transparently delivered to the addressee. It lets users who cannot run their station full-time get mail automatically In a batch process whenever the machine is available. It also includes a program that allows the error- and trouble-free file transfers of large (500 MB and more) binary files, without monopolizing the frequency, even at 1200 baud.

What is this system? It's called TCP/IP (Transmission Control Protocol/Internet Protocol) and it is available to the radio amateur in the form of KA9Q NOS (Network Operating System). TCP/IP—often called just plain "IP"—is a protocol for communications and a set of utility programs that offer the services discussed above. Phil Karns KA9Q wrote the seminal version of TCP/IP for amateur radio, and his source code is the basis for all of the available versions today—and there are lots!

The other thing to be aware of about TCP/IP is that it is the standard for communications on the Internet. Yes, the Internet—our present information superhighway. This fact has led to the use of the Internet—which goes everywhere—to connect amateurs from all over the world using "wormholes." These are point-to-point connections over the Internet. To get an idea of the practical effect of this situation, imagine a theoretical ham in Bloomington, IN. This is the location of K9IU, an amateur TCP/IP station connected directly to the Internet. From this location, our ham can connect to Hawaii, Australia, California, Chicago, Holland, and Canada by using a low-power VHF radio.

Now, you can do this with a normal packet station, since the NOS package offers a BBS interface for such connections. But if you run some form of NOS, it is possible to directly interact with resources anywhere on the amateur TCP/IP packet radio network.

Getting Started with TCP/IP

So now you know why, here's what we were doing: JNOS. JNOS is a version of KA9Q NOS, modified by Johann WG7J. This version of NOS was chosen for several reasons, among them:

It is widely used and available.
It is feature-rich.
It is stable.
It is still being developed—though Johann has chosen to take a break.
I use it.

To run JNOS, you need the JNOS package. You will find many versions out there and, version 1.07b is the recommended, though not the latest, one. You can get this on the *73* BBS (603-924-9343, 300-2400 baud, 8 data bits, no parity, one stop bit) and many other sources. Check any ham radio BBS that you use—it is most likely there.

You also need a PC, though not anything fancy. An XT will work, an AT is better, a 486 is better yet. You get the idea: the bigger the better. Finally, you need a TNC and a radio. JNOS uses the TNC in "KISS" mode (Keep II Simple, Stupid), so your TNC must have this capability—most do, but check.

The only other thing you'll need is help and patience. The help you can get here and where you live; the patience is up to you. Using JNOS is lots of fun, and it offers much more than the run-of-the-mill packet operation. Keep reading this column as we continue this series.

A Product You Should Consider

There is a product out there that has not gotten the attention it deserves. It is a good idea, is executed well, and is very useful to many hams. The product I am referring to is called the "PC Packet Station."

All in One

The PC Packet Station is a 3/4 PC expansion card with a BayCom 1200 baud packet modem and a 5W two-channel Motorola VHF radio. Plug this board into your PC, load the supplied software, and plug in an antenna—your packet station is on the air. No radio wiring, no TNC wiring, no used-up serial port, and no space taken up in the shackl This may be just what many of you have been looking for. You can also use the unit with TCP/IP by loading the widely available AX25DRV driver for the BayCom modem.

The software supplied is a comprehensive terminal program specifically designed for packet radio. When combined with the PC Packet Station board, the result is a slick, easy-to-install-and-use package—a real solution for many of you.

Another Good Reason To Buy

I don't know about you, but I really like to buy things that are:

Made in the USA.
Obviously a labor of love.
Supporting a US-based startup amateur radio manufacturer.

The PC Packet Station fits all three categories, and deserves your support. To find out more about the PC Packet station, contact:

PKT Electronics, Inc.
2668 Haverstraw Ave.
Dayton, OH 45414
(513) 454-0242 (voice)
(513) 454-0029 (fax)

ATV

Number 23 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Winterfest

This past January I attended the annual Monterey, California, hamfest (called Winterfest). Sponsored by the Naval Postgraduate School Amateur Radio Club, this event offers a nice flea market stocked full of unique goodies, as well as a great series of inside booths and forums covering just about every special interest facet of ham radio.

This year's ATV exhibit was manned by Doug McKinney KC3RL, Rene KD6OCP and Ian Bible KE4EAC. One of the unique aspects of their display was a live demo of Ian's mobile R/C ATV off-road vehicle.

R/C CarCam

Capable of sending back an exhilarating ground level view of the hamfest while racing up and down the aisles, Ian's R/C carcam proved to be a real-crowd pleaser. The ATV booth was usually quite busy as onlookers watched the high-speed antics of the carcam. The carcam was very popular with the kids as well. Every time I saw the carcam race by, it was followed by an entourage of kids trying their best to catch it. A number of times Ian took the car out to an open area near the flea market and thrilled us all with some very high-speed (about 60 mph) runs across the parking lot.

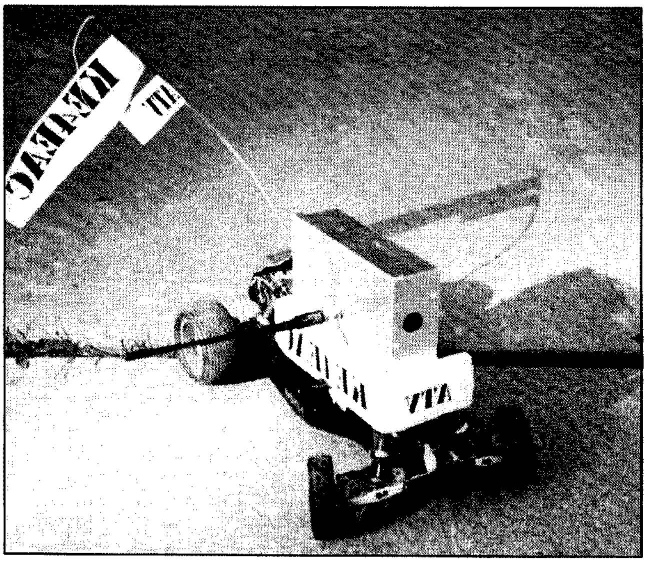

Photo A. The ATV carcam system consists of a R/C off-road vehicle carrying a 1 watt ATV transmitter and camera.

The CarCam System

An avid R/C off-road enthusiast, Ian got the idea that it would be fun to install an ATV system on his R/C car for the hamfest demo. The off-road model he used is made by Team Associated (model RC10) and is powered by a NiCd pack capable of about eight minutes operation.

The ATV system consisted of a Marshall Electronics Micro Miniature b/w camera (model #1206, 380 lines and 0.5 lux) and a 1 watt KPA5 P.C. Electronics transmitter. Packaged in an aluminum box with eight AA-cell batteries and a rubber duck antenna, this made for a very compact package capable of being mounted to the R/C car. The AA batteries usually lasted several hours and Ian carried extra NiCd packs for the car's power system. Since the NiCd packs could be quick-charged in 20 minutes, Ian could keep the car running nearly continually during the hamfest.

To attach the ATV package to the R/C vehicle, Ian cut out a block of styrofoam to fit between the car and the ATV module (see Photo A). He secured everything with nylon straps which held on nicely even during the highest-speed runs.

Using the 75 MHz system that came with the R/C vehicle, Ian could control the car out to about 300 yards while the ATV transmitter was running. He found that there was a lot less interference to his R/C system when using 439.25 MHz instead of 426.25 MHz.

Photo B. Ian Bible KE4EAC can control his R/C off-road ATV vehicle out to nearly 300 yards and reach speeds approaching 65 mph.

A Versatile System

If you plan on making your own R/C carcam, you could use just about any moderate-sized off-road model. Depending on the distance you intend to cover, you could extend the battery life and the weight of the transmitter system by using a lower power transmitter (for example, P.C. Electronics also offers a postage-stamp-size transmitter that puts out 80 milliwatts). Although the R/C carcam system makes for a great hamfest demo, it could be adapted for a number of other Interesting uses. This kind of ATV system could be used in robotics and maybe even as a probe for hazardous situations. Imagine being able to send a small R/C vehicle carrying an ATV transmitter into a fire or emergency area.

Number 24 on your Feedback card

ABOVE & BEYOND

VHF And Above Operation

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Converting HF SSB Systems for Microwave Use

This month I will cover an HF-to-VHF transceiver conversion that can serve as a single-sideband IF system for use with microwave converters. Some of us are lucky enough to have a 2 meter multimode rig that can be devoted to the job. However, there is a growing need among those who can't invest heavy bucks into such a package to dedicate it for microwave use. You can purchase a multimode rig for 2 meters, but watch out for the price—it might shock you. That's the reason for this month's topic, a viable alternative to a very pricey VHF multimode rig. I believe that the most economical method to achieve this goal is to convert or modify an existing high frequency SSB radio for use on 2 meters, which is a good choice for microwave IF.

Why don't we use 28 MHz directly for the microwave converters? Well, the main purpose of converting 28 MHz to 145 MHz is that when using a 28 MHz source to drive a microwave converter, the image frequency produced in mixing is not removed by filtering of the microwave products. The bandwidths of most microwave filters are not narrow enough to pass the real signal and remove or attenuate the image signal. By converting 28 MHz to 145 MHz we now have an image product that is offset in frequency by some 300 MHz rather than 60 MHz. The image at 300 MHz is a lot easier to filter out with conventional microwave filters. Another benefit of this conversion is that you have a low-power transceiver that can be used for 2 meter SSB work as a bonus package.

That's the direction we will be going this month: modifying an older SSB solid-state transceiver for 80 to 10 meters, and adapting a few modules to make it into a 2 meter SSB IF system. This conversion project is in response to many letters I have received inquiring about how one can obtain an inexpensive SSB transceiver for microwave use. The project descriptions should give you some ideas on what to look for, especially on a limited budget.

Choosing Parts and Construction Methods

I don't expect you to follow the exact construction and modifications I preformed on the radio I selected. I used the Atlas PC boards because they were readily available and served as an example of one method to reach the goal.

I have several 2 meter SSB transceivers in use at present, but I had lots of fun constructing the HF base SSB system for this example. I've got to let my passion for the workbench be expressed: I love it. The HF PC board I used for this project was damaged and had to be repaired. I had to do that—it was ripe for this project. In any case, that's what I selected for the HF SSB generator portion of the 2 meter SSB transceiver. I hope you put your swap-meet talents on alert for bargains to use surplus material or other low-priced equipment requiring just a modest investment to make the 2 meter SSB system goal reachable.

This description is one of many methods available to build your system. The best selection for an SSB system is a solid-state unit, but a tube-type unit will work, with obvious limitations for portable operation. Typical HF rigs lack FM operation, another possible mode that could be useful for microwave operation. Not having FM should not be a problem as there are so many 2 meter FM HTs available if you are considering FM as a alternate mode to SSB. I feel this limitation is not worth considering as SSB is the prime mode of operation contemplated. Let's get a basic approach and then start modification on my selection, the Atlas R-100. See Figure 1, the block diagram of the system.

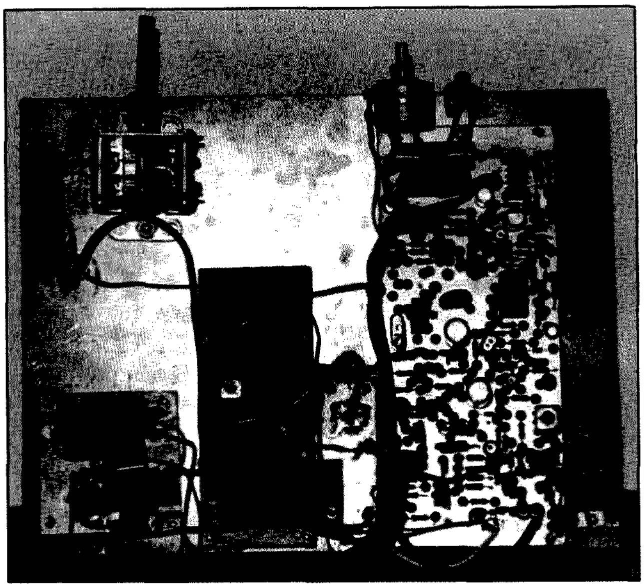


Photo A. The Atlas R-100 receiver constructed from scrap PC boards. VFO and other shield compartments removed for photograph.

Here's a little background on the performance of a similar system constructed by John WB6BKR, a member of the San Diego Microwave Group. John uses the same Atlas base system that I am about to describe. The microwave end of the system is a MA/COM commercial dish and transceiver originally intended for telephone-type service. It required an IF near 2 meters and John built up an SSB transceiver using the same scheme to be described here. The PC boards were part of an Atlas R-100 80 meter to 10 meter receiver. The transmitter, a T-100 Novice type CW and SSB transmitter, was an add-on option, sort of a "buy the option and add it on as you go" type of rig. The transmitter unit is not required in the modification as only the mike audio circuit is needed, along with the receiver PC board and a relay switching R/T voltages.

Remember, any small similar HF PC board system can be used. The basic components from some other HF commercial device that is small and could be adaptable to converter use can also fill the bill. I suggest you look at the possibility of obtaining one of the Heathkit monobanders, the Atlas or Swan monobanders, the Radio Shack 10 meter transceiver, or some other similar type SSB HF radio, to do the job. I mention monobanders because when these show up at swap meets they do not carry a high price tag. Some are tube-type and demand a lot less in the expense column. That's a big plus for home stations and economy. The solid-state versions can be somewhat more costly, but they are still relatively inexpensive when located at swap meets.

The Modification

In any case, the modification consists of removing or disabling the power amplifier circuitry as only low-level RF is required for transverter operation. Most converters require less than 10 mW of RF for transmit operation. By way of comparison, I have never repaired the defective RF final of my 2 meter SSB HT, a Santec multimode rig that I use for microwave conversion as it's not necessary to have several watts of

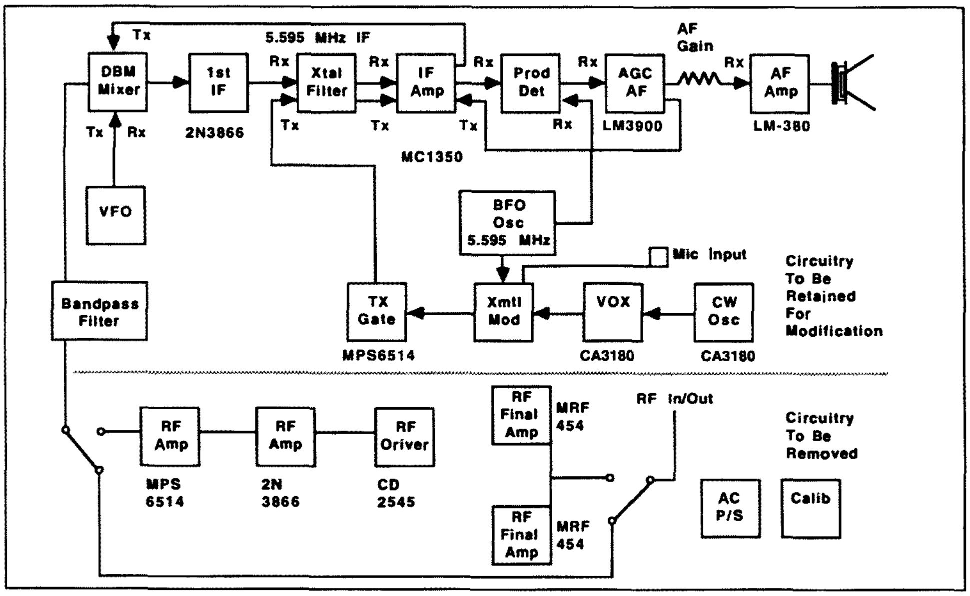


Figure 1. Block diagram of the Atlas RT-100 system. Atlas R/T 100 SSB transceiver circuitry switched from REC to XMT with relay activated by mike PTT switch "T" line grounded in receive and switched to +12V in transmit.

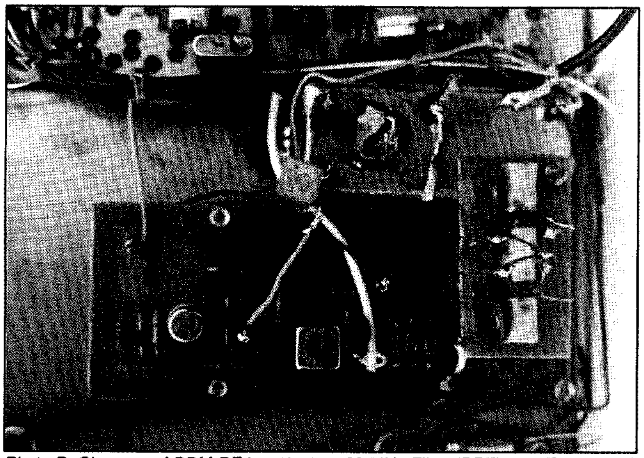


Photo B. Close-up of DBM RF input/output 28 MHz Filter (BPF), 1st IF and XTAL filter at 5.595 MHz. Lead dress not critical—shown for ease of construction.

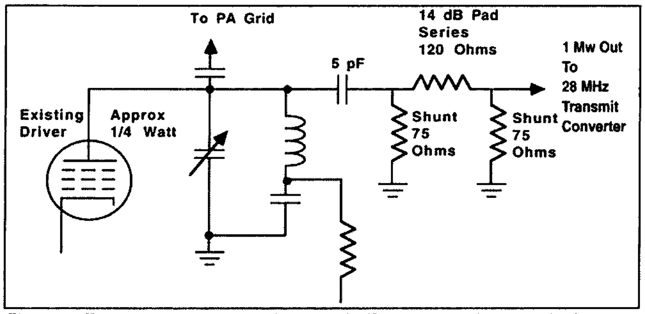


Figure 2. Transmitter output coupling circuit. Transmitter driver circuit shows attenuator attached to tube-type driver to reduce power at driver output to level suitable for Hamtronics transmit converter. Use 2 watt carbon resistors. Keep all leads short.

power in this application. Without the final transistor, this rig puts out about 75 mW and is just right for most microwave IF systems with a 10 dB attenuator.

By the way, I picked my Santec multimode HT up for $50 as a "Basket Case," essentially a case and a bag full of PC boards and components. It did not work at first, but with a lot of troubleshooting and love it is back on the air. Possibly you can do something similar. You just have to keep your eyes open.

Let's get on with the conversion description of the Atlas RT-100 HF SSB/CW transceiver. The beauty of this system is that only the PC board from the basic receiver is required to construct a Single SideBand (SSB) transceiver.

In the case of a tube-type driver circuit, low-level power can be taped off the driver stage if you don't want to remove the final circuitry from operation. See Figure 2 for suitable output coupling circuits for a tube-type rig. The circuit in Figure 2 will not be needed if you build a similar transceiver driver as I have done as the power is limited to a few mW. See Figure 3 for a low-power indicator.

The Atlas Radio used in this modification was part of an R-100 and T-100 80 through 10 meter beginner SSB and CW transceiver—basically a Novice CW rig that had SSB capability. The SSB capability was there when the Novice got his upgrade license and could then use that portion of the radio. It was built to be a "purchase the feature as you upgrade" entry in the amateur market.

The Atlas T-100 came stock with a 5 watt final and could be upgraded to add a 100 watt amplifier into the transmitter chassis, which is remote and alongside the receiver cabinet. In any case, the thing to focus on is obtaining something similar, an HF SSB transceiver that is inexpensive, and mainly solid-state. This fills most of the goals towards an SSB IF system for 2 meters or whatever IF frequency you intend to use.

See Photo A, the basic Atlas R-100 PC board and the system I constructed for 28 MHz SSB. Left behind in this modification was all the band switching (80/10 meters) as it was not required. The transmitter circuitry, save for the mike audio circuit, was constructed in the lower left corner, dead-bug style. See Figure 4 for the mike schematic used in the example. The main receiver PC board contained the second IF, product detector, BFO, AGC and audio amplifier. The BFO, product detector and IF amplifier serve dual purposes and are active in transmit when the audio amp and AGC are de-activated.

The SSB filter was mounted exter-

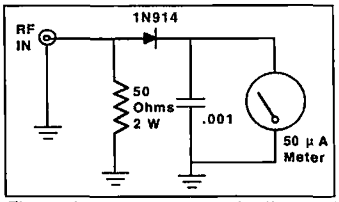


Figure 3. Low-power termination and power indicator. Use carbon resistor—other types might be inductive, causing improper termination of RF.

nally and the first mixer and first IF amplifier were mounted on another PC board. Reconstructing these PC boards made for a very small transceiver. Actually, the reconstruction was necessary because the radio (Atlas R-100) looked like a truck ran over it, and salvaging the PC boards was necessary.

I chose to re-construct the transceiver dead-bug style on a scrap of PC board to better demonstrate the system. I left the shielding off for photographic purposes. In the final version I moved the VFO from the top left corner of the PC board to the middle of the board; Photo A was taken before this was done. In the old VFO spot I placed the Hamtronics 144 MHz to 28 MHz receiving converter. Now, in your conversion you might not be able to obtain the Atlas R-100 PC boards that I used for examples but in most cases the principle is the same. You are looking for circuitry and a filter platform on which to construct your transceiver or a complete HF rig for 28 MHz, and to incorporate the Hamtronics modules for 2 meter operation.

You don't have to tear apart your stand-alone 28 MHz SSB transceiver as it can be converted in place. It's your choice of size and how you want to configure your system. The biggest problem in using a 28 MHz transceiver as it stands is that the high-power output must be attenuated before it can be used with a microwave converter. I operate from batteries and excessive current draw on batteries is detrimental. Why generate high power of 20 to 100 watts only to attenuate it back down to a very low level for injection into a transverter?

Removing or disabling this part of the circuit reduces these problems, and battery current draw is minimized. Just because I re-packaged the system doesn't mean you must; it's a matter of choice. If the re-packaging seems intimidating then keep the radio in stock condition and construct a converter as an external device. The choice is yours: modify or re-construct. I chose to start from scratch from a junked radio because it was available. Use what you can locate.

Looking at the system block diagram of the Atlas R/T-100, it is clear that for transverter operation high power finals are not required. Only about 20 to 50 mW of power are needed in this application. Output power from the mixer circuitry in transmit is in the range of 1 to 10 mW and is quite adequate for most up-converting schemes. This makes drive to the VHF 2 meter mixer quite simple.

Construction

A word of caution before you contemplate ripping apart your SSB radio: Think the process through before removing PC boards and circuitry. I once observed a 10-speed bicycle being torn apart to give it a real spiffy paint job, and not all the parts could be found when the paint job was complete. The bike became a pile of junk. This happened due to lack of planning and documentation of the pieces. Don't let lack of planning happen to you.

If you are thinking that this is too much of a project to attempt, possibly you should construct a portion of the circuitry first and give it a try. If you are unsure of just what to construct, let me suggest a VFO for starters. When it's complete, test it and if all seems OK, move on with the project in a portion of the circuit as you go. Don't look at the entire project as a whole. Keep it in perspective, one stage tied to another, and test as such, stage by stage. In that way you will not be overwhelmed by the entire circuit. As you proceed from one circuit to another, in small steps carefully planned out, you should build up success and confidence as you proceed. Remember: Do not rip out all the circuitry at once but rather move in a predetermined pattern towards a planned goal. When a large circuit is looked at as component modules, the entire scope of any modification becomes much clearer. In most cases the radio can be returned to the original condition by careful planning and labeling of cut leads when disabling circuitry. Keep records and drawings of your mods.

I tested the PC boards in my system in a circuit, module by module. In this way a complicated circuit becomes small chunks of circuitry and easier to test. Check for obvious shorts in DC distribution and apply power when clear. Check the basic unit as a receiver. Start with the audio amplifier and move back towards the IF, then the RF part of the circuit. Don't worry about the transmit circuitry now, get the basic receiver working. Test the IF amplifier and the crystal filter circuitry. If you have a signal generator it can be used prior to construction of the VFO. Use test equipment at your bench to your best advantage by furnishing missing signals to determine just what is not functioning properly.

When you have the receiver operating, start to check out the transmitter circuits. Many of the transmitter circuits are common to the receiver circuit being used in a dual fashion in the Atlas R-100. They are switched by the "T" control line from receiver configuration to transmit configuration with steering diodes and associated coupling circuits. It's a simple and effective scheme, allowing the VFO mixer and IF amplifier to reconfigure the circuit for transmit from receive. In receive, the mixer has the VFO injection and converts the an-

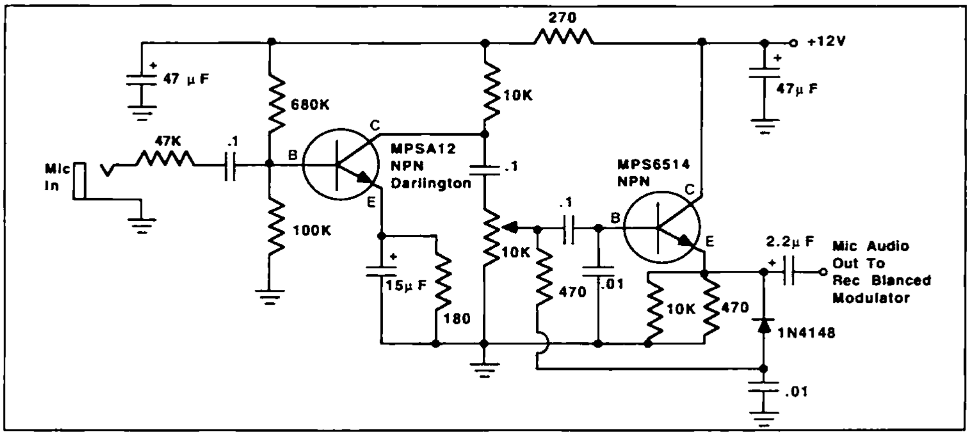


Figure 4. Mike audio circuit for the Atlas R-100 conversion. CW keying and sidetone circuits removed.

tenna-received RF to the IF and on to the detection circuits. In transmit, the mike audio is mixed with the BFO crystal and injected into the input of the IF amplifier. The output is no longer connected to the receiving product detector; it is fed to the filter. The output of the filter is then fed to the front-end mixer, which is bidirectional (the first IF amp isn't used). Voilà! Low-power output (a few mW) to the antenna on transmit.

The nice thing when working with a low-power transmitter circuit such as this is that you can hold the transmit "T" line in transmit for long periods of time without worry about over-dissipating finals (there are none). Power output is, as I stated earlier, 20 to 50 mW.

Observation of output signal can be confirmed with a power meter, SWR bridge, or o-scope. If you don't have an indicator you can make one from a 1/2 watt 50 ohm resistor and a diode connected to a sensitive microamp meter for an indicator. See Figure 3. Whatever type of device you use to test the modified rig at 28 MHz, use a terminating resistor of 50 ohms. Any power rating will do just fine; 1/2 or 1/4 watt is actually an overkill, but here common components work well. You can listen to audio quality on your base station as a monitor. So much for indicators. I have been saving that discussion and a bunch of other items as simple test adjuncts for a VHF bench test equipment column. I won't go into details here but rather save it for that time.

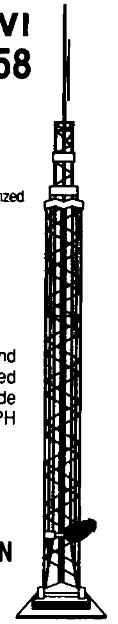
Hamtronics Kit Option

The next part of the system, converting from 28 MHz to 2 meters, 144 MHz, will follow in next month's column. I thought about designing a transmit/receive converter from 10 meters to 2 meters but then I saw the Hamtronics advertisement in *73*—they provide kits ready to go. Why re-invent the wheel? Hamtronics has done all the hard work and provided in kit form just what I was looking for, a Hamtronics XV2 transmit converter and a CA144 receive converter. I had several reasons for making this choice: Hamtronics is an established company with quality kits, and their pricing is very reasonable. My prime goals were low cost and modest labor output on my part, and these kits certainly fill the bill.

The XV2 transmitter kit and the receiver kit CA144-28 were both designed to convert 28 MHz to 144 MHz Xmtr, and 144 MHz to 28 MHz for receive. The transmitter costs $89 and the receiver kit is $49, for a total cost of less than $150, which is quite reasonable. Coupling these kits with the HF SSB transceiver, your modification will complete the package for a 2 meter SSB system for microwave IF use.

You may wonder why I went to the trouble of constructing a 28 MHz system when I already have SSB systems for microwave use and you might question my sanity. Let me assure you that I constructed this working system to demonstrate that it is possible to homebrew with surplus components. I hope this re-generates interest in home-brew construction, as this is not difficult nor expensive.

Well, that's it for this month. Next month I will cover the construction of the Hamtronics converters part of this project for 2 meter SSB operation. As always, I will be glad to answer questions pertaining to this and similar topics. Please send an SASE for a prompt response. 73 Chuck WB6IGP



Number 25 on your Feedback card

ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM
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Plug and Play?

Before we get to this month's topic, I'd like to discuss a letter I received from a reader named Rick, who gave no call, no last name and no address. He pointed out that, in my January column, my drawing of the transistor model using two diodes was not physically correct, and he sent photocopied pages from a transistor theory book showing that the internal construction of a bipolar transistor is actually like two back-to-back diodes, with the base connection between them.

Before others start complaining about it, please understand that I was not trying to describe the insides of a transistor! Rick is right that my representation is not physically true, but it wasn't intended to be. Rather, I was trying to show what a transistor looks like to external currents *when it is conducting*. The physically correct model makes it awfully hard to imagine how current could ever flow between the emitter and collector without a deep understanding of the "holes and carriers" physics stuff that goes on in the junctions. I was trying to avoid that, and my diagram was correct for its intended purpose. I'm sorry for any confusion that may have caused. Anyway, Rick, whoever you are, thanks for writing; it's good to know we still have knowledgeable hams out there who care about electronics.

AC Adapters

Have you ever wanted to run your walkie, QRP rig or some other small piece of ham gear from the AC line without resorting to an expensive power supply? Or, perhaps you bought something at a hamfest and it needs an AC adapter, but you didn't get it and have no idea of the voltage or polarity. And I'm sure you've seen those boxes of ultra-cheap adapters at the 'fests and drooled over the opportunity to get inexpensive DC power for your stuff. From what I've seen, no device causes more damage to small electronics than the AC adapter! Specifically, the problems occur when the wrong adapter is used. Matching an adapter to a piece of gear may, at first glance, seem trivial, but there's more to it than meets the plug. Let's take a look.

Matchmaker, Matchmaker

Before you even consider plugging the adapter into the gear, check to see how closely the voltages, currents and polarity match. The polarity is a non-negotiable item; if you get it backwards, you are probably gonna cause some serious damage to your device. That's how most gadgets get trashed by adapters, because people assume that a plug which fits means correct polarity, and it just ain't so. In fact, it used to be that most manufacturers were pretty consistent among their models, but even that much "standardization" has disappeared. I've seen Sony products with opposite polarities, although they tend to use different-sized plugs to avoid disaster. Some other companies are not as careful. This is one point you simply must not fail to double-check.

If it's not written on the case, determining the polarity of an AC adapter is as easy as plugging it in and measuring the voltage with your voltmeter. But, sans markings, how can you determine the polarity of your device? Sometimes, the only way is to open it up and follow the leads back to the board. Almost certainly, you'll come to an electrolytic capacitor, and you can read the polarity from its markings. As usual, plus goes to plus and minus to minus. If you can't find one directly connected to the power input, take a look at the other electrolytics. All, or nearly all, of them will have the same side going to ground, which usually is the largest trace on the board, and will nearly always be connected to any shields or IF cans. Most likely it'll be negative, although there are a few positive-ground devices out there, especially old ones. Whichever side goes to ground is the same polarity as the incoming power's connection to ground. I've used this polarity-determining technique numerous times, and it has never failed me. One more thing: Some adapters output AC instead of DC, and you must never try to use them on a normal, DC-operated device or you'll probably ruin it. Conversely, an AC-output adapter must be used on an AC-input gadget. Many phone answerers use AC input and perform the AC-to-DC conversion inside, so they can derive both positive and negative voltages for their circuits.

Ideally, the adapter's voltage should be the same as that required by the device; a 6-volt radio should have a 6-volt adapter. But, is there really such a thing? Usually, no. Most equipment is internally voltage-regulated, and very few adapters have any regulators in them. A 6-volt adapter may indeed provide about 6 volts *at its rated current capacity*, but might measure 9 or 10 volts with a much lighter load. The thing to remember here is that most equipment expects this; that's the reason for the internal voltage regulators. They do that for two reasons: Unregulated adapters are very cheap, and the use of internal regulation lets them get the most from a set of batteries.

Here's why: Let's say you have a 6-volt circuit, and it won't run properly on less than 5 volts. If you run it on 4 AA cells, that'll give you 6 volts when the batteries are new, and all will be fine. As the batteries run down, the voltage will begin to approach the 5-volt cutoff level. When each cell is at 1.25 volts, the circuit will begin to malfunction. But, at 1.25 volts, those cells have significant energy left! Why waste it? If you use 6 cells, you'll start at 9 volts, but you won't get down to 5 until those things are really *dead*. Proportionally, the batteries will last a great deal longer. There are other issues involved, such as the difference between using a linear regulator (common and cheap but wasteful of energy) and a switching regulator (more expensive but much more efficient), and how close the regulator's input and output voltages can get before the regulation fails.

The upshot of all this is that most AC adapters have widely varying output voltages, and it behooves you to take a look at the current requirements of your device. If you use an 800-mA adapter to power a 100-mA device, chances are the adapter will be giving you much higher voltage than its ratings specify. Is that good or bad?

It can work for or against you. If you want to power a 9-volt, 100-mA device and you only have a 7.5-volt, 500-mA adapter, you may just find that it all works out fine, thanks to the adapter's voltage being higher at the lighter load. If, though, you want to power a 6-volt, 100-mA device with a 6-volt, 800-mA adapter, you might be getting more voltage than you want, despite the identical voltage ratings. In that case, take a look at whether the device has internal regulation; the higher input voltage may not matter, as long as the extra dissipation doesn't over-

heat the regulator, and the incoming voltage isn't at or above the voltage ratings of any electrolytics on the unregulated side.

Finally, I've seen plenty of adapters that didn't actually live up to their ratings. I remember some 9- and 12-volt adapters which were supposed to deliver 500 mA. Above about 400 mA, the voltage dropped well below the ratings! The only way to know for sure is to measure the voltage while the adapter is actually powering the device.

By the way, the usual result of overstressing an AC adapter is hum in the equipment, due to the adapter's filter capacitors getting heavily drained between AC cycles. When stressed, full-wave-rectified adapters will do better than half-wave units, but even they give up eventually. Everything has limits.

A Good Fit

Obviously, if you want to be able to plug the adapter into the gadget, the plug must match the socket. Although various kinds of plugs are used, the two most common ones are the earphone-type 1/8" and the coaxial. The coaxial dominates the field, and, unfortunately, there are lots of different sizes of them! Due to their structure, there's an inner diameter to worry about, as well as the outer one. You might think that, as long as the thing fits into the hole, all will be well. That's often true, but not always. Two problems can arise: First, the center pin on the jack may not make contact if the plug's inner diameter is too big. The plug fits in fine, but the darned thing just won't work. Or, it'll work if you push on one side of the plug, but when you let go it dies. Second, if the plug's outer diameter is too small, it may not push hard enough against the jack's spring switch. That can have serious consequences, especially if the equipment also uses batteries which get disconnected when you insert the adapter's plug. If the spring switch doesn't open, the adapter may send power to those batteries. If they're non-rechargeable types, you could have a leaky, caustic mess with which to contend. To avoid that problem, I always check for voltage on the battery contacts while I wiggle the adapter's plug around. The voltage should read zero unless the equipment has a charging circuit for NiCds.

The length of the coaxial plugs varies, too. I haven't found it to make too much difference, though, when the plug was too long. If part of the plug hangs out, just be careful not to cause a short between the exposed sleeve and anything else, particularly in the car. If the sleeve's polarity is positive and you short it to something metal on the car, which is negative, you're looking for trouble. If the plug is too short, it may work fine, but you might run into the problem I described above, in which the jack's spring switch doesn't get properly contacted.

Finally, some manufacturers use non-standard plugs and jacks. Sometimes it's intentional, sometimes not. For instance, the ICOM IC-2iA uses an odd variation on the coaxial theme in which the center pin is in the plug instead of the jack; only their plug will fit. And, my Yaesu FT-530 uses what looks like a standard jack, but I haven't been able to find anything, anywhere, that fits it, because its outer diameter is just a little too small.

Other Issues

Sometimes, you seem to have enough current capacity, but you still experience hum, especially in a receiver. You might just need some extra filtering, but the problem also can be caused by a rather obscure phenomenon known as "re-radiation." What happens is that incoming signals, and sometimes the radio's own oscillators, get into the adapter via the AC line or the DC wires. They get rectified in the adapter's diodes, and then they get re-radiated back out the DC wires, where they are picked up by the receiver. The result is that the signals get modulated by the 60-Hz line frequency with each zero cross of the diodes, and you hear it as hum. Many adapters have 0.1 or 0.01 µF caps across the diodes, but sometimes it just doesn't work. It's a difficult problem to cure, and I've experienced it many times with miniature TV sets, where it shows up as a small hum bar riding up the screen. By the way, direct-conversion receivers are so prone to picking this stuff up that most are extremely unsuitable for use with adapters. Battery operation, of course, does away with the problem.

If you try to operate an HT on an adapter, you may run into something similar, wherein your transmissions have hum on them, even though you've got plenty of current capacity. It's your own RF that's getting into the adapter. Sometimes you can cure it with a toroid on the DC wires, sometimes you can't.

Finally, here's a trick you can use when you want to operate something which has a normal current drain within the adapter's specs, but which has momentary demands the adapter can't provide. I ran into that when I tried to rig up an adapter for a little 8-mm video recorder that took several times its normal current for just a moment whenever the eject button was pressed. That caused the adapter's voltage to drop low enough to shut the recorder down. I put a 9600 µF cap across the adapter's output lines, and it stored enough current to prop the whole thing up for the fraction of a second that was required.

Well, I told you there was more to AC adapters than just plug and play! See you all next month. 73 de KB1UM.

73 INTERNATIONAL

Number 26 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

Well, my computer seems to be fixed (I hope). It was acting flaky in more than one way so I thought it might have something to do with the BIOS chip. I removed that and then placed it back in the socket. That seems to have fixed the problem. I guess the chip had been in the socket for so long that the pins got a little corroded.

We have a new Hambassador stepping into the light. Bill Meara N2CQR/HI8, who has sent several newsworthy letters from the Dominican Republic, has asked to become its Hambassador. From the letters he has provided I know that he will make an excellent Hambassador. Welcome aboard, Bill! We look forward to more news from DR.

I received a copy of a letter to Wayne from Dean Hale KF7CR, who commented on a letter to Wayne from Nat V. in Bangalore, India. Dean travels to India regularly and has already sent a letter to Nat so that they might meet. Doesn't that sound like fun! Dean advises that if we are to travel to India, be prepared. India has its share of eye-openers. International travelers need to accept that they aren't in total control of the situation. They are a guest in the host country. Flexibility and patience are important qualities.

Most travel literature is full of glossy pictures and romanticized info. For the business traveler, he recommends the All Asia Guide *published by the Far East Asia Economic Review. He also recommends* India, A Travel Survival Kit *by Lonely Planet Publications. The latter is written by two Englishmen and a Nepalese. A good bookstore will stock either book. The classic* Freedom at Midnight *by Larry Collins and Dominique Lapierre gives a good sense of contemporary Indian history . . . and a peek into the Indian mind.*

If any of our readers are interested in travel to India, Dean will be glad to be a resource. Feel free to call him at work (503-687-2202) or at home (503-683-2985). Tell him that 73 sent you.

Congratulations to Woodson Gannaway (Canary Islands' Hambassador) and his wife on the arrival of their first child, Layli Rose Tahirih, born October 27. One of Woodson's neighbors calls her "nino todo terreno," which translates to "four-wheel-drive kid." She goes everywhere with Woodson, so the neighbor has a point!

Now, on to some great news from the world of ham radio. 73, Arnie N1BAC.

Roundup

Russia The "Russian Robinson Club" was created in early 1993 and is interested in the world islands program—Islands On The Air (IOTA). It has supported more than 10 island Arctic DXpeditions in 1993, two of which are new IOTAs: 4K2RRC (EU 019); 4K3RRC (EU 082); 4K4RRC (AS 005); 4K5RRC (AS 025); 4K3GW (EU 161); 4K3WQ (EU 162); 4K3/RW3GW (EU 082); 4K3/RA1ZA; 4K3/RA1WQ; UW1ZZ/A (EU 082); UW1ZZ/A (EU 162); and 4K4DV (AS 029). During this year, the Russian island national diploma program (RRA) has been developed like the national island programs of Italy (IIA), Spain (IDEA), France (DIFM), Portugal (DIP), and Polska (SP IOTA A). Competitors in this program have received more than 120 diplomas. We greatly hope that interest in the Russian national island program (RRA) will be increased every year.

RRC publishes a magazine-report every quarter which gives information about members of the club, the last island, polar and sea expeditions, IOTA News, and provides a databank of Russian island stations, Antarctic stations (4K1), and much more.

Like most DX organizations, we need your support so that our program can continue. We would like to thank you in advance if you could donate anything (money, equipment, etc.) to our cause. All sponsors will receive, free-of-charge, our magazine-report, "Russian Robinson News."

RRC invites all interested hams from different countries of the world to arrange joint expeditions to the islands of Russia. The RRC can help to arrange any visit to any island of Russia and to settle all organization problems. We wait for your suggestions!

Please communicate with our headquarters: RRC, PO Box 3, 398000, Lipetsk, Russia; NSI. Ltd. (RRC), 429 South 321 St., Place # E 10, Federal Way, WA 98003, USA; I1HYW (RRC), Gianni Varetto, PO Box 1, 10060, Pancalieri, (Torino), Italy. Our E-Mail: victor @ stack. serpukhov. su.; Packet: UV3DIN @ W2XO.#WPA.PA.USA. NOAM.

Best Robinson wishes from RW3GW, V. Sushkov.

India The All India Amateur Radio Convention for 1994 will be held in Bangalore April 9-10. This event is called "Hamvention-94." It is sponsored by the National Institute of Amateur Radio and hosted by the Institution of Engineers. The venue is also the Institution of Engineers (Karnataka State Centre), Bangalore.

The theme of the Hamvention is "Ham Radio—A Global Fraternity." It will focus on various aspects of this unique hobby. An exhibition of instruments relating to the hobby, HAMPEX-94 (a stamp exhibition on related subjects) and a Ham-Esperanto meet are planned, along with other usual presentation sessions. Delegates from India and abroad are invited to participate.

For a tree brochure and registration forms, write to: Nagesh Upadhyaya VU2NUD, General Convenor, PO Box 1129, Bangalore 560 011, India.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

4X1RU HF-VHF Gateway Going QRT For the past six years, Jim Stone 4X1RU has been running an HF-VHF Packet Radio Gateway. He has dedicated his HF transceiver, amplifier, and beam antenna to this end, and spends about three hours of his time daily keeping everything orderly and running smoothly. For us in 4X-Land, his station is the main junction tor all messages and bulletins to and from outside the country. We daily check into one of the four BBSs on 2 metres, and get a list of about 60 new bulletins from all over the world, as well as sending and receiving our own personal mail. All this goes through 4X1RU, and without his efforts, VHF-UHF packet radio in Israel would be pretty boring.

However, it turns out that most of the hams benefiting from Jim's efforts are outside of Israel. Because of the strategic position of Israel between three continents, as well as the peculiarities of 20 metre propagation, much of the traffic to and between Europe passes through 4X1RU on 20 metres. Jim points out that the Pyrenees mountain range acts as a barrier, and he is the main link between Spain and the rest of Europe. 4X1RU says that there are difficulties in the European UHF backbone packet network, and as a result much of the traffic is routed through him. In the past, because of the U.S. FCC rulings about third-party traffic, messages for Europe from the States could be addressed only via Israel, with whom a third-party traffic agreement existed.

Anyone who has hooked up his TNC and computer to an HF rig and watched the packet traffic on 14.107 MHz wonders how any serious messages can move at all there on 20 metres. At 300 bps, a quarter of the speed on VHF, the problem is compounded by the abundance of QRM, and it seems to take forever for a paragraph to be transferred. Nonetheless, 4X1RU moves an average of *one megabyte* a day of messages and bulletins on the frequency.

Jim will now be able to participate in other amateur radio activities (like talking to his friends around the world on HF SSB) and be able to communicate on VHF, which is jammed all the time by the BBS running on VHF. After a "vacation" from all this activity, Jim hopes to investigate activities such a PACTOR and CLOVER.

Thanks, Jim, for all the years of service. Your act is indeed a hard one to follow. Be seeing you on the bands!

VHF-UHF Link to Eilat The trusty team of 4X1OM, 4Z5AY, 4X6PH, 4X6WP, and 4X6ZH installed the first stage of the link bringing to Israel's southernmost point reliable ham communications with the rest of the country. Installed at Shaharut, overlooking the Arava highway from about 50 kms. north of Eilat, the link is tied into the 145.325 Yatir repeater, which covers from the Tel-Aviv area down to the Central Negev. The link relays what is heard on 145.325 to 434.500 MHz, and if 145.325 is quiet, then a signal transmitted on 435.500 will be relayed to the input of the Yatir (in the center of Israel) repeater to be heard on its output. A UHF yagi points down the Arava Road to Eilat and the VHF yagi beams north 160 kms to the Yatir repeater. A 91.5 Hz CTCSS subaudible tone is necessary on both ends of the system.

As these lines are being written, the task of completing the rest of the VHF-UHF-VHF link with Eilat has been completed. *It works!* The link's backbone, located in Shaharut, uses the UHF simplex frequency of 433.300, working into a VHF transceiver in Eilat on one end and the Yatir R13 VHF repeater in the hills north of Beer-Sheva on the other side. In Eilat, you may work using a handie operating on R12 (145.300—offset, as with a standard VHF repeater). You will not hear a squelch tail when you leave the PTT, as it is not acting as a VHF repeater but, rather, is relaying the signal to UHF. The frequency split is just for operating convenience. It can be used as a repeater in Eilat, though, it you use a dual-band rig, transmit on 144.700 and listen on 433.300. And, driving along the Arava highway north of Eilat, you will be linked into both Eilat VHF and the Yatir repeater by working simplex on 433.300. In all cases, a PL tone of 91.5 Hz must be used.

Now all you need is a 2 metre handie-talkie while basking in the sun at this Red Sea resort town and you're in touch with the centre of the country. It was pointed out that this is a true pioneering triumph of ham radio in Israel as there is actually no commercial service at any price that will presently allow you, in Eilat, the same range of hand-held or mobile communications. Hats off to our IARC repeater crew for their imagination, hard work, and pulling off of this terrific job!

MONACO

Daniel Plett 3A2LZ
B.P. 349
MC 98007
Monaco

Monaco has had its share of amateur radio visitors this past month. DK6AS paid us another visit, operating from his hotel room. Another ham came from the UK to operate the CQWW CW contest. Unfortunately, he had equipment and health problems and had to return home before the contest even began.

One visitor who is legal is F9UW. He has been operating mobile/portable

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73 INTERNATIONAL

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from here for years, is fully legal, and also QSLs.

On the subject of visiting hams, not all hams claiming to be from the Principality are actually operating from here. One case in point is 3A2CC. We have been receiving many cards at the A.R.M. for this station. The claimed contacts are mainly for August 1993. This callsign has never been issued by Monaco officials and has never been heard here. If you contacted this station . . . sorry, it doesn't count for anything.

Pirates show up fairly regularly. My own callsign was pirated, especially on 15 meter CW during 1989. All current licensees are listed in most callbooks. The next series of licenses will be in the 3A2M? series.

Congratulations to a couple of Monaco hams. One of them received a U.S. Extra Class license and another, 3A2LU, has qualified for the Worked All States (WAS) Award. To my knowledge this is the first one issued to a Monaco ham.

Finally, the 3A CW group has been issued the callsign 3A2CW. Hopefully this callsign will be appearing on the air soon.

PEOPLE'S REPUBLIC OF CHINA

Rick Niu, Chief Op., BY1QH
Room 316 Building 25
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Beijing 100084
People's Republic of China

Sorry Es Happy Our apology for the delay in issuing this 17th issue because of two busy weeks with the satellite ground station. Thank goodness we are not too late to deliver our cordial Season's Greetings: We all wish you and your family a Merry Christmas and Happy New Year 1994!

Silent Night A Christmas party was held by TUARC on the evening of November 18, 1993, in a nicely decorated bar near Tsinghua University. All of the club members and many of our Chinese and foreign ham pals took part. A double-layer cake with the sign "HAM 1993" on it was ordered and a BT2000BJ videotape produced by the Worldwide Television News was shown.

China on OSCARS First off, our sincere gratitude goes to John KD2BD for his popular *SpaceNews* (29-Nov.-1993), where our effort to get BY on OSCAR 13 was well-mentioned. We are happy to report that, as of now, all the antenna system and proper connections with the Yaesu V/UHF transceiver have been set up and working. However, nothing has been heard on the SSB when the bird, according to InstantTrack, is overhead. Several packet bulletins regarding a solar eclipse that has stood in the way of normal AO-13 operation have been noted but there might be something else that went wrong. TUARC will appreciate *your* instructions if you have had any experience with the OSCAR satellites or you are a regular user of AO-13. Any reference books would be welcome.

TNX Marconi If you have been carefully searching around 30, 40 and 80 meters lately, you might have come up with BY1QH on CW! Yes—Rick, Sean and our dear old friend Dieter DJ7BU are fairly active on the low bands. Keep listening and we won't let you down: 1430-1600 and 2230-2330 UTC. QSL via the *Callbook*.

First BY2 BY2AA, the first and currently the only station in Region 2, is located at the Sports Commission of Heilongjiang Province in Harbin, Northeast China. Equipped with a TS-180S and a TS-520D, the club started to work the world on SSB and CW on May 3, 1993. Two operators are known to be active: Mr. Li Feng, BZ2LF and Ms. Li Ruqin. QSL via PO Box 89, Harbin, Heilongjiang Province 150001, China.

BA Net They are not a large community, but they are heard every day. This best describes what the BA hams are doing. Every Sunday around 0000 UTC, thousands of Chinese SWLs lock their frequency on 14180 kHz—the BA Net—listening for the most noted 20-odd Chinese hams. What's more, a 2 meter net is "triggered" as well, both in Beijing and Shanghai, when the clock hand points to 8:30 p.m. local time.

The BY2-3 List By July 5, 1993, the following 11 stations (shown alphabetically) have been registered in Regions 2 and 3:

(Call-QSL info) BY2AA-PO Box 89, Harbin, Heilongjiang Province 150001; BY3AA-PO Box 7, Tianjin 300040; BY3AB-PO Box 7, Tianjin 300040; BY3AC-PO Box 7, Tianjin 300040; BY3AD-PO Box 7, Tianjin 300040; BY3AE-PO Box 61, Tianjin 300270; BY3AF-PO Box 7, Tianjin 300040; BY3AG-PO Box 7, Tianjin 300040; BY3AH-PO Box 7, Tianjin 300040; BY3AI-PO Box 551, Tanggu, Tianjin 300452; BY3CC-PO Box 2, Tianjin 300020.

Who's Who at BY1QH Sean, a second-year E.E. student, is one of the youngest but most zealous members of TUARC. After his first meeting with Rick BZ1QL, in November 1992, the open-minded, smart boy quickly became hooked on the hobby, and has been very much involved in almost all of the club activities since. "What a terrific relaxation, working on the radio while forgetting about the pressure from schooling!" Crazy about constructing antennas, Sean is also starting to teach himself CW through the SuperMorse program, and may be heard on the low bands from time to time during the winter season. Acting as a Public Relations Group member, he not only does a super job as BZ1LUV, but also gets the hang of his university subjects very well. "We are always learning, both about the radio and about the life, especially about getting along with various kinds of people. TUARC has taught me a lot of things, and I am very lucky to be in this club and know these guys."

Thanks! Our hearty appreciation this time goes to BZ1AA Tong, BZ1HAM Chen, DJ7BU Dieter, EA4AD Jesus, GW3GJQ Roy, K6DGW Fred, K8OQL Jerry, KA3BMS Hank, KD2BD John, KO4XM Bob, N1BAC Arnie, N5VGC Presley, OE2CAL Walter, SM5BDV Lars, VE7CIZ George, VK5ADD Donald, W5KSI Angelo, ZL1KG John, ZL2MAX Max, and especially, Mitsuo JA5TX for his wonderful Pactor BBS service and Bob NØARY for his state-of-the-art packet-Internet gateway.

TUARC can be reached via any of the following paths: packet—BY1QH @ JA5TX.JPN.AS; Internet—contact Bob, gateway_request@Arasmith.com. For more info, airmail: Rick Niu, Public Relations Manager TUARC, Room 316 Building 25, Tsinghua University, Beijing 100084, People's Republic of China. *[Packet relayed by KE7XO]*

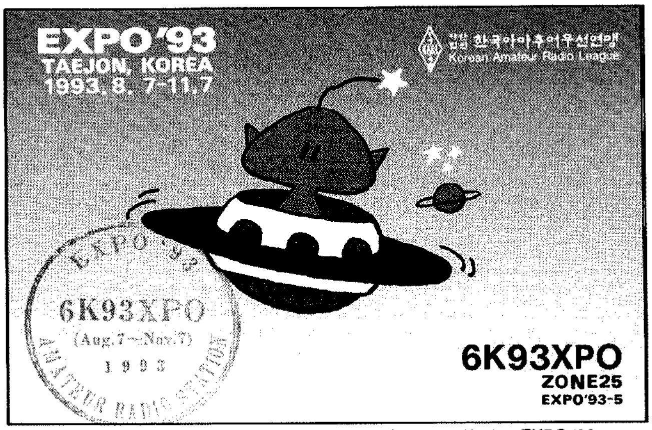

Photo A: QSL card from the Special Event Station at Taejon EXPO '93.

REPUBLIC OF KOREA

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157-7 Kwangan-2Dong, Nam-Ku
Pusan 608-102
Korea

Let me offer all my sincerest congratulations upon the arrival of the New Year.

I am happy to say that amateur radio station 6K93XPO at the 1993 Taejon International Exposition was a great success. I served as a volunteer operator from August 1 to 31, and it was very enjoyable. I am sending along the QSL card and a copy of the certificate for your use. I am also happy to announce that the EXPO Award has been extended one year to December 31, 1994.

The Taejon '93 EXPO Award may be earned by contacting and confirming contact with 6K93XPO and any other HL QSO made after April 1, 1991. Yes, it only requires two QSOs. The award is also awarded to SWLs. Over 10,000 certificates have been printed. Send the two QSL cards and eight IRCs to: Award Desk, KARL, PO Box 162, C.P.O. Seoul, 100-601, Korea; Tel.: 02-817-7493; Fax: 02-817-7494. Apply until December 31, 1994.

From June to November 1993 I operated with a special callsign, HL93AP, and made contacts with 1400 DX stations and 80 DXCC countries. If you were one of those stations, please QSL to the address above. 73

NEVER SAY DIE

Continued from page 4

tune with the times. They have yet to issue the first American patent in the cold fusion field. Tsk.

Why Stop at Digital?

Digital is good. It's all zeros and ones, marks and spaces, yeses and nos. It's also cumbersome as all hell. It takes eight bits of ASCII code to communicate one lousy letter. I don't know how good you are at counting by twos, but in the digital world you only need two fingers to count. It takes a little getting used to. Why do we need eight bits? Well, if we used one bit we'd get two choices. With two bits we have four. Three bits gives us eight possible combinations. So, where we want to be able to communicate 26 upper case letters, 26 more lower case, 10 numbers, and a bunch of punctuation marks and special characters, we're out to eight bits. That gives us 256 combinations.

Some of the early DEC minicomputers made do with six-bit code, but this only provided 64 combinations, so it slowed them way down when they were used for word processing.

The old Teletype code only had five bits, so we were stuck with only 32 combinations. Maybe you noticed that telegrams were all upper shift letters. The Teletype keyboard had the 26 letters in the lower shift and the numbers in the upper shift, along with most of the punctuation. One key put you in the upper shift. Another was a carriage return, and so on.

Okay, enough about history, now we're going way out into left field. Are you ready for a stretch? One of our problems today has to do with the slowness of communications. We're up around 9,600 baud for much of our landline stuff, and that beats the heck out of the 60 words per minute Teletype speed we started with, and the 100 words per minute we graduated into. Bauds? Bits? When we use ASCII we send our characters in eight-bit groups, plus a start bit, a stop bit, and a parity bit. That's 11 bits for sending one letter or number . . . a byte.

Do I have to explain that parity bit? That's in there to tell you when something somewhere in the system is screwed up. Your computer adds up all the bits in one byte and checks to see if the number is odd or even. If you decide on even parity, it adds a bit to any odd bit number. Thus, if the computer getting the data runs across a byte with an odd number of bits it lights up tilt, telling you that something is amiss.

So, at 9,600 baud we're actually getting about 872 characters a second. Divide by six to convert that into words and you're throughputting about 145 words per second. That's faster than most of us can read. That's over 8,700 words per minute.

It's too slow. We can do better than that. Yes, I know there are some dohinkies that can boost that to 14,400 baud, but it ain't easy. Or cheap.

Trigital?

Now let's just suppose that instead of sending just zeros and ones, that we drive the engineers totally bonkers by sending ones, twos and threes. Our frequency shift keying will then have three frequencies instead of two. Right away that gives us seven combinations instead of two. 1, 2, 3, 1-2, 1-3, 2-3, 1-2-3. If two choices gives us digital, then three should be trigital, right?

With digital and two bits we have four possible combinations. With trigital we have 49. With three bits we have 343 combinations . . . more than enough to handle just about anything in the way of special characters. So we've reduced the number of bits from eight to three for the same throughput. That's 2.7 times the speed with the same number of bits. That's like sending at 25,600 baud.

Now, before you get too excited over this I want to take back one of those combinations and use it just as a start bit. I'd like to use the 1-2-3 combination for this. This will then act as a reference for the three tones. This takes us down to six possible combinations we can use for our bits instead of seven. Three bits will provide us with 216 combinations, which is more than enough to take care of upper and lower case letters, the 10 numbers, lots of punctuation, and plenty of special characters such as dollar and yen signs, brackets, etc.

"Okay, enough about history, now we're going way out into left field. Are you ready for a stretch?"

I'm not done yet. Let's suppose we want to speed things up a little. See where I'm heading? No? Okay, I'll explain. Let's say that we use three bits for most of the ASCII code combinations. That's fine if we don't mind spelling out even the most often used words. But, if we send four bits we'll have 1,296 combinations and thus be able to communicate 1,296 of the most often used words by just adding one bit. This will cover a surprising amount of our normal communications. We could be nasty about it and lean toward shortening words like "communication" to one character, as well as our more often used shorter words.

Hey, we're dealing with computers here, so we can make 'em do almost anything we want, building the complexity into a cheap chip . . . so let's consider going out even one more bit, so we'll have a larger dictionary. Now we're out to 7,776 possible combinations. That's a pretty good-sized dictionary, one large enough so we aren't going to have to spell many words out.

If your computer gets a three-bit "word" it'll translate it into a single character. If it gets four bits it produces one of the next 1,296 words. Five bits opens us to another 7,776 words, and we're still beating the heck out of slowpoke digital. Now we're covered for over 99% of the words used in normal communications.

It wouldn't be very difficult to specify at the beginning of a message if a special dictionary is going to be used. In this way we could have one for doctors, another for lawyers, engineers, computer tweaks, and so on. Even one for hams with all the Q-codes built right in.

Wait, there's more. If we want to have secure communications we can just shuffle those bits a little and the words coming out will be gibberish, unless you have the key.

I'm not done yet. Next, let's suppose that you're in communications with someone who doesn't know English. Like Japanese, for instance. No, most of them know English. Make it Chinese or Arabic. How are we going to do this the easy way? No strain. When you are busy typing in your message your computer will be checking each word as you type for multiple meanings. Then, when you're done, in addition to your normal spelling check, it'll stop at each word with a multiple meaning and ask which meaning you have in mind. The dictionary it uses for this will assign bit groups to concepts instead of just words. I'll cheat on this and add a sixth bit, giving us a 46,600 concept dictionary. That ought to hold us for most communications. We can afford to be a little slower on our throughput when we're providing an automatic translation into any language in the world. We'll still run circles around 9,600 baud ASCII.

With throughput like this we'd be able to transmit for a second or two and send whole stories. It would take around one and a half seconds for me to send a 16-page booklet. The story of my recent trip to Hawaii for the cold fusion conference, plus scuba diving on all six major islands, would take maybe 15 seconds to zip through. Of course you might prefer to not be burdened with reading and just want a signal and weather report. I can do that in a millisecond and be on to more fruitful contacts.

I thought you might enjoy the concept, even though I realize that no one will probably bother to make it happen. Even though someone could easily get disgustingly, filthy rich by developing it and selling the systems . . . and not just to hams. Hey, put me down for 2%, okay?

Breast Cancer

A reader who, for some perverse reason, enjoyed my editorial on bioelectricity, wrote to say that while he was visiting England a few years ago the BBC broadcast a program showing a breast cancer treatment in Sweden where they put a probe (needle) in the middle of the cancer with +12 volts on it and ringed the cancer with -12V probes. The result after a short application of the voltage was a quick cure.

You'll learn more about this sort of thing in the Bob Becker books I recommended.

I'm reminded of Michael Crichton's book, *Travels*, where he pointed out that radical mastectomy for breast cancer as an example of superstitious behavior in that there is no scientific evidence that there are any benefits. Except perhaps to the doctors and hospitals, who reap millions. Mike was a doctor before he got into writing and directing. You'll enjoy this $4.95 pocketbook. Look for it.

Free Music? What's This, Another Con Job?

We keep hearing there's no free lunch, but every time someone puts out some food we belly up to the table and start eating, hoping this time it's for real. So what's all this free music stuff? What's the catch? Well, it isn't totally free, but it's darned close. Close enough so you can build one heck of a music library for peanuts. You can build yours the same way I built mine. The English language is pitiful when it comes to expressing feelings, so I can't begin to tell you how excited, happy, sad, enthralled I am when listening to Joplin, Nazareth, Sibelius, Glière. No more than I can explain the excitement of skiing hard and fast down a slope or scuba diving on a reef full of fish. Why are contests so much fun? Why do DXers chase a rare one for hours? What's the fun of sitting in some rare country and working the pileups?

But a music library is something you have for life. I can pull out *The Music Man* CD from Telarc and enjoy the incredibleness of the music, the lyrics, the performance and the recording. We haven't got the words in English to communicate this. Nor can I ever really explain to you the feelings of combined happiness and angst I experience in listening to Joplin's music as played by Scott Kirby. Or the emotional experience of César Franck's symphony played on a good hi-fi system. I can only do my best and hope you'll join me in enjoying the things I have found so exciting.

You? A Music Expert?

Yes, you! Look, everybody, including you, likes some kind of music. Whether you enjoy rock, ragtime, blues, Dixieland, jazz, bluegrass, polka, or old-time fiddle music, there are some kinds of music that you like. You are a music expert on one thing: the music you like to hear. Okay, now I've got a way you can cash in on your expertise.

Sure, some people like music more than others. Some not only listen to music on the radio and buy records, they go to concerts! A few even go to music festivals, which are popping up

all around the country. Even way up here in the mountains of New Hampshire we have a restaurant that specializes in blues (Rynborn in Antrim), another in folk music (The Folkway in Peterborough), and one in bluegrass (Del Rossi's in Dublin).

But no matter how much or little you love music, you are an expert on what music you like, and there are record companies out there that want to find out what you like. This is where the Music Research Foundation comes in. This is also where you can build one heck of a music collection for peanuts. Damned near free, actually.

So who's going to shell out to send you music and why? Just put yourself in the big fat luxurious chair of a record company executive. You know the odds are only about one in 20 that your next new release is going to pay for itself, much less be a hit. And this despite all the experts you have on your staff, and your own intuition. It's worth a lot to you to have a focus group listen to your new releases and rate each one on how much they like it. You don't want music-Ph.D. expert opinions, you want to know how much the general public is going to like your release.

Record Companies Need to Know

This information allows the record companies to put their major promotion money behind the winners and not waste big bucks on losers. Promotion can't make a lousy record into a hit, but the lack of it can keep good music from getting anywhere. This same information is also helpful for record store managers when they're deciding how many copies of a new title they should order.

The Music Research Foundation has been providing this rating service to a few record companies, but it's been so successful in picking hits that now many more want it. Thus, the Foundation is looking for volunteers to get newly released CDs and cassettes and rate them. The record companies provide the review CDs and CAs to the Foundation for the Research Associate groups. All the Foundation charges is $3.86 each for CDs and $2.77 for cassettes, just to cover the handling, shipping and record-keeping.

"So what's all this free music stuff? What's the catch? "

Since there are many types of music, the Foundation needs hundreds more Associates to help evaluate them all. If you're interested, let the Foundation know what kinds of music you like and send a $10 registration fee (check or credit card) to cover the cost of setting up your enrollment and shipping the first three CDs or CAs for you to rate.

Over the last 10 years I've rated well over 5,000 new CD releases, plus I've written some 3,000 in-depth reviews for my music publications. The result is that I have built a superb music collection of classical, ragtime, theater organ, operettas, country, bluegrass, folk music, foreign, dance, show tunes, old time piano, choral, and so on. Nope, not much rock, blues, new age, or jazz. With several hundred new releases every month, there's no shortage of music.

You Haven't Got Time?

Somehow, despite my fairly busy schedule, I manage to put in at least an hour a day listening to new releases. Even on trips I have a portable CD player with me and a box of CDs to rate. That's "work" that is very relaxing. Scientists are just now beginning to recognize the therapeutic aspects of music. Heck, when I was the Executive Director of the Music Research Foundation back in 1952 I worked with a group of New York's top psychiatrists and psychoanalysists and wrote a book on the subject which the Foundation published.

Record companies and record retailers need to know which new releases you, as a representative of the general public, like. So give them and yourself a break and start getting your almost free music. Most of the CDs sell for from $15 to $20, so you can build a valuable CD collection in short order. I know mine couldn't be replaced for $100,000.

Here's your opportunity to have fun, build an enviable music collection, and help the music industry to improve its product. Wouldn't it be great if the ham manufacturers wanted vox pop reactions to their products? Dream away—but listen to some wonderful music while you're dreaming.

Send your $10 to: The Music Research Foundation, Research Associate Fulfillment Division, 70 R 202 N, Peterborough NH 03458-1107, or call 800-234-8458 with your credit card number.

Ordering Books and CDs

[Editor's Note: Wayne often references books and CDs in his editorials. The books are often available from Uncle Wayne's Bookshelf; the CDs from IMPS by Mail. Both can be ordered by telephoning (800) 234-8458 or (603) 924-4196, or by faxing (603) 924-8613.]

SPECIAL EVENTS

Number 27 on your Feedback card

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our* ***BBS (603-924-9343).*** *for listings that were too late to get into publication.*

APRIL 2

CHESAPEAKE, VA C.A.R.S. "Springfest" Amateur Radio/Computer Show will be held at the Virginia Beach Pavilion from 8 AM-3 PM. VE Exams given by CDXA. Talk-in on 146.97-. Dealer Contact: *Preston P. Ipock N4SHI, 1026 Calloway Ave., Chesapeake VA 23324. Tel. (804) 543-4610.* Flea Market Contact: *Robert M. Holt N4SFH, 2539 Roundtree Cir., Chesapeake VA 23323. Tel. (804) 487-1896.*

COLUMBUS, IN The Columbus ARC will host a Hamfest at Bartholomew County 4-H Fair Grounds, Family Arts Bldg., on State Rd. 11, from 8 AM-2 PM. Talk-in on 146.790/.190. Make reservations thru *Marion Winterberg WD9HTN, 11941 W. Sawmill Rd., Columbus IN 47201. Tel. (812) 342-4670.*

EAST LYME, CT The Southeast Connecticut Radio Amateur Mobile Soc. (SCRAMS) will hold its annual Spring Auction at the Senior Citizens Center, Waterford Municipal Complex. Setup at 9 AM. Auction from 10 AM until sold out. Bring your equipment to be auctioned. Talk-in on 146.07/.67 Rptr. For info, call *KA1BB at (203) 739-8016.*

LONGMONT, CO The Longmont ARC will hold its annual LARCFEST from 8 AM-3 PM at the Boulder County Fairgrounds, Hover and Nelson Rds. VE Exams at 1 PM. Talk-in on 147.27/.87 or 146.52. Contact *Randy Stevens N0NMD, 5280 Cypress Dr., Boulder CO 80303. Tel. (303) 499-1106.*

APRIL 9

FERGUS FALLS, MN The Lake Region AC will sponsor their 7th annual ARRL Affiliated Hamfest between 8 AM-3 PM, at the Hockey Arena, Otter Tail County Fairgrounds. VE Exams. ARRL Forum. Packet Meeting. More. Contact *Keith McKay N0FKF, Rt 1 Box 46, Battle Lake MN 56515. Tel. (218) 826-6274.*

LAWTON, OK The Lawton Ft. Sill ARC will hold the 48th annual LFSARC HAMFEST from 8 AM-5 PM at the Comanche County Fairgrounds in Lawton. Talk-in on 146.91/.31. Write to *Bob Morford KA5YED, 1415 N.W. 33rd St., Lawton OK 73505;* or call *(405) 355-6120.*

ROCHESTER, MN The Rochester Area Hamfest/Computer & Electronic Show will begin at 8 AM at John Adams Jr. H.S., 1525 31st St. NW. Talk-in on 146.22/.82 (W0MXW Rptr.); 223.22/224.32 (W0MXW Rptr.). Contact *Rochester ARC, Attn: Colleen Vaneps N0ZDY, 707 11 1/2 St. SW, Rochester MN 55902. Tel. (507) 280-9102.*

APRIL 10

MADISON, WI The Madison Area Repeater Assn., Inc., will hold its 22nd annual Madison Swapfest at the Dane County Exposition Center Forum Bldg. beginning at 8 AM. (Set-up 7 AM). Talk-in on 147.75/.15 on the M.A.R.A. Rptr. (WB9AER). Reservation deadline is March 31st. Write to *M.A.R.A., P.O. Box 8890, Madison WI 53708-8890;* or call *Jim Waldorf KB9AQQ, (608) 249-7579.* Leave a message on the answering machine.

NEW CASTLE, DE The Penn-Del ARC will present its annual Hamfest at the Nur Temple on RT. 13. Open 8 AM-2 PM (setup at 6:45 AM. Register for VE Exams at 9 AM. Packet and ATV Demos. Talk-in on 147.225+ and 224.220/R. Send reservations to *Penn-Del Hamfest, P.O. Box 1964, Boothwyn PA 19061.* For info call *(302) 798-7270.*

TRENTON, NJ The Delaware Valley Radio Assn. will sponsor HAMCOMP '94, their 22nd annual Flea Market of amateur radio and computer equipment. The event will be held from 8 AM-1 PM on the campus of Trenton State College, Route 31, Ewing Township, Trenton NJ. Wheelchair accessible. Talk-in on 146.07/.67. Contact *HAMCOMP '94, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240.*

APRIL 16

JOPLIN, MO A Hamfest, sponsored by the Joplin ARC, will be held at John Q. Hammons Trade Center from 8 AM-3 PM. VE Exams. Flea Market. More. Talk-in on 147.210+. Call for details at *(417) 623-3610 (days); (417) 782-5848 (eves);* or *J.A.R.C., P.O. Box 2983, Joplin MO 64803.*

APRIL 17

RALEIGH, NC The Raleigh ARS will present its 22nd Hamfest, ARRL NC State Convention and Computer Fair, in the Jim Graham Bldg., NCS Fairgrounds, from 8 AM-4 PM. ARRL, QWCA, MARS, ARES, more. Pre-register for VE Exams by calling *AA4MY at (919) 847-8512.* For info, contact *Rollin Ransom NF4P, 1421 Parks Village Rd., Zebulon NC 27597. Tel. (919) 269-4406.* Talk-in on 146.64 -600.

APRIL 30

SONOMA, CA The Valley of the Moon ARC, WB6DWY, will hold its annual "Ham" and Egg Breakfast and Swap Meet, starting at 8 AM at the Sonoma Veteran's Memorial Bldg., 126 First St. West. VE Exams; walk-in, with registration at 10 AM. Testing begins at 11 AM. Talk-in on 147.47 simplex, and the 145.35 -600 and 146.205 +600 Rptrs, PL 88.5. Contact *Darrel WD6BOR, (707) 996-4494.*

MAY 1

BURLINGTON, IA Valley Emergency Comm. Assn. will host Burlington Hamfest '94 from 7:30 AM-3 PM, at the Burlington Drive-In Theater, Agency St. (off U.S. 34

and U.S. 61). Talk-in on 146.790/.190 W0LAC/R and 146.520 simplex. Contact *Chuck Gysi N2DUP, Burlington Hamfest '94, P.O. Box 911, Burlington IA 52601-0911*, or call *(319) 752-3000 (voice/fax).*

YONKERS, NY The Metro 70cm. Network will present a Giant Electronic Flea Market at Lincoln H.S., 9 AM-3 PM, rain or shine. VE Exams. Talk-in on 440.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 Hz; and 443.350 MHz PL 156.7. Mail paid reservations to *METRO 70 CM NETWORK, 53 Hayward St., Yonkers NY 10704*. For details, call *Otto Supliski WB2SLQ, (914) 969-1053.*

MAY 7

MANITOWOC, WI The Mancorad RC will hold its annual Hamfest from 8 AM-?? at the Manitowoc County Expo Ctr. Amateur/Computer/Electronics Flea Market. VE Exams. Contact w/SASE to *Mancorad RC, P.O. Box 204, Manitowoc WI 54221-0204*; or call *Red, (414) 684-9097 days; Ron (414) 793-4733 eves.*

SPECIAL EVENT STATIONS

APRIL 2-3

TULSA, OK The Tulsa ARC will celebrate its 70th Anniversary by operating W5OK, from 18:00Z 2 April-18:00Z 3 April. Frequencies: Phone—lower 50 kHz of the General 15, 20, 40, 80 meter subbands, and the Novice 10 meter subband. There will also be a 2 meter SSB station. CW—lower 25 kHz of the General 20, 40, 80 meter subbands and the Novice 15 meter subband. For a unique certificate, send QSL and a 9x12 SASE to *Tulsa ARC, P.O. Box 4283, Tulsa OK 74159.*

APRIL 3-9

TWEED HEADS, N.S.W., AUSTRALIA Station VI2CQ will operate approx. 2300 UTC-0000 UTC and 0300 UTC-0500 UTC from Camp Quality (Kids with Cancer), in the Tweed Heads area of NE New South Wales. It will be manned mainly by the VK4 Gold Coast ARS Inc. Frequencies: 7.050, 14.150, 21.150 and 29.550, all +/- QRM. QSL via *VK2CYI, VK2 Bureau*. A QSL card will be sent for all contacts.

APRIL 7

GLENBROOK, N.S.W. In commemoration of the 140th Anniversary of the first Morse telegraph circuit in Australia (between Melbourne and Williamstown), the Sydney Morsecodians Fraternity will establish a Morse link between Melbourne and Williamstown (with the venues at each end yet to be identified). The Science Centre in Canberra will be linked with both terminals so that messages may be exchanged between the three centers. Visitors will be able to send brief telegrams to relatives or friends, without charge.

APRIL 9-10

GREEN VALLEY, AZ The Green Valley ARC will operate KC7MF 1600Z April 9th-2300Z April 10th, to commemorate the closing of all TITAN 2 Missile Sites in the USA. Phone Bands: 3.860 (AM or SB), 7.230, 14.250, 21.330, 28.450 MHz. For local 2m Rptr. operation, use 145.290 MHz (-600). For a certificate, send QSL and an 8x12 SASE to *GVARC, 601 N. La Canada, Green Valley AZ 85614.*

APRIL 11

MOBILE, AL The Mobile ARC will operate K4RQQ in commemoration of the 94th Anniversary of Submarines USN. Operation will be from the USS DRUM at Battleship Park. Frequencies: 20m 14.220-14.280; 146.22/.82 for locals. For a certificate, send QSL and 9x12 SASE to *Murray Flanders K4ROQ, 9075 Howells Ferry Rd., Semmes AL 36575-7502.*

APRIL 22-23

ADAMS, NY Members of Jefferson County ARC will operate N2DMZ 1400Z-2400Z April 22nd and 23rd, to commemorate the birth of J. Sterling Morton, the founder of Arbor Day. Operation will be in the lower 25 MHz of General 80, 40, 20 and 15m CW and phone subands. Try 14.060 +/- for CW QRP. For a special QSL card, send SASE and QSL to *John Wagner N2DMZ, 20 Robert St., Adams NY 13605.*

APRIL 22-24

BAY CITY, TX The Matagorda County ARC will operate N5QWF from 0000Z-2400Z April 22-24, to celebrate the Bay City Centennial. The Station will operate on all bands, in all modes. For a QSL card, send SASE to *N5QWF, 4404 Doris St., Bay City TX 77414.*

SPARKS, GA The Middle Georgia Pro Ams will sponsor Station AA4RI, to commemorate the 100th Anniversary of "wireless" and the 120th Anniversary of Guglielmo Marconi's birth (25 April 1874). Operation will begin 22 April at 2100 UTC, and continue until 1800 UTC 24 April. Listen for AA4RI in the lower 25 kHz of the General bands. Hams traveling on 1-75 will be invited to visit and operate this Station. For a certificate, send a 9x12 SASE, with QSL card to *Curtis Carter, 114 Belmont Dr., Warner Robins GA 31088*. For DX stations not desiring a certificate, QSL cards will go out via the bureau.

APRIL 29-30

DAYTON, OH Special Event Station W8BI/8 will again operate from the Dayton Hamvention Flea Market, during Flea Market hours (1200Z-2200Z April 29th; 1000Z-2100Z April 30th. Operation will be in the General and Novice phone, and CW portions (as band conditions dictate). W8BI/8 QSLs 100% to hams and SWLs. To QSL, send a business-size SASE to *W8BI/8, P.O. Box 44, Dayton OH 45401.*

APRIL 30

SONOMA VALLEY, CA The Valley of the Moon ARC, WB6DWY, will operate in commemoration of the City of Sonoma and the Valley of the Moon's rich historical heritage, from 1700 UTC-2400 UTC. The station will be operated during the club's annual Hamfest. Listen throughout the day on the General phone portions of 10, 20 and 40m. For a nice parchment certificate, QSL with SASE to *VOMARC, 358 Patten St., Sonoma CA 95476.*

APRIL 30-MAY 1

PHILADELPHIA, PA The Olympia ARC will operate WA3BAT from 1300Z April 30th-2000Z May 1st, to commemorate the 96th Anniversary of Admiral Dewey's triumph over the Spanish Fleet at the Battle of Manilla Bay. SSB/Phone—3.898, 7.268, 14.268, 21.368, 28.368, 145.270, and packet. For a certificate, send QSL and a 9x12 SASE to *Olympia ARC, P.O. Box 928, Philadelphia PA 19105.*

Number 30 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

April is usually a very good month for RF propagation, and should be fairly good this year in spite of the declining sunspot numbers and solar flux levels. Don't expect April to be a passive month, however, as there are signs of possible ionospheric upsets and disturbances in the earth's magnetic field, particularly between the 6th and 10th of the month. You may also expect some other geophysical effects around this time, such as storms in the atmosphere and other manifestations in the earth itself, but *not as great* as the January 17th-21st period. Such occurrences need not happen only in the United States, either, but they will likely be somewhere on earth.

Winter has transitioned into spring in the Northern Hemisphere, and the usual thunderstorm activities in lower elevations and snow in the higher ones, such as the Rocky Mountains, can be expected. Anticipated DX conditions during the month follow.

10-12 Meters

Fairly good daytime conditions on north-south paths, particularly in the afternoon. Also some east-west openings to Africa and the Pacific on Good (G) days. Short skip between 1,000 and 2,000 miles will occur during the daytime hours, with movement to the west following the sun. These bands will close around local nightfall.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	20						15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U S S R							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	20	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U S S R								20	20			

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20	20				15
PHILIPPINES	15							40		20		
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U S S R									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

15-17 Meters

Fairly good DX openings to all areas of the world on Good (G) days, and occasionally on Fair (F) days or days trending from Fair to Good or vice versa. Expect openings from the Northern Hemisphere to Africa, South America and the Pacific, peaking in the afternoon. Short skip, during daylight hours, of 1,000 miles or so is likely on many days.

20 Meters

Very good DX openings to all areas of the world from sunrise through the early hours of darkness. Openings should peak an hour or two after sunrise and again in the afternoon. Short skip openings beyond 750 miles should occur during most days in the daylight hours. This should be your best band for DX opportunities, with strong signals on Good (G) days.

30 and 40 Meters

Fairly good worldwide DX openings from early evening through sunrise. Short skip will occur over 1,000 miles during hours of darkness, and between 100 and 1,000 miles during daylight hours. The 30 meter band exhibits some characteristics of 20 meters and some of 40 meters. These bands are subject to thunderstorm QRN, however, and on Fair (F) days signals may not be much above the noise level. Static crashes are always a problem when thunderstorms are present within the skip zones.

80 and 160 Meters

These are the wintertime bands, when noise levels are low, but some good results can be obtained this month, too, particularly from the Northern Hemisphere to Central and South America and other areas of the Southern Hemisphere. East-west openings are rare but daylight short skip openings of up to 350 miles are possible on 80 meters, and over 500 miles during nighttime hours. On 160 meters, you will find some DX openings that peak around midnight and around sunrise, but there will be NO daylight chances for short skip or otherwise because of high signal absorption levels during the day.

In general, April may turn out to be one of the better months until fall for your DX opportunities. Because of the lower values of solar flux, openings will be fewer in number and farther between. Use the charts wisely for best results, and monitor WWV at 18 minutes after each hour for updates on the ionosphere.

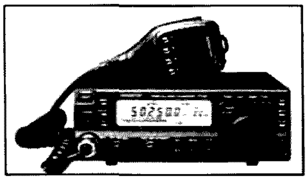
April 1994

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P-F	2 F
3 F	4 F	5 F-P	6 P	7 VP	8 P	9 P
10 VP	11 P	12 P	13 P-F	14 F	15 F-G	16 G-F
17 F-G	18 G	19 G-F	20 F-G	21 G	22 G-F	23 F-P
24 P-F	25 F	26 F	27 F	28 F-G	29 G	30 G-F

NEW PRODUCTS

Number 28 on your Feedback card

Compiled by Charles Warrington WA1RZW



KENWOOD

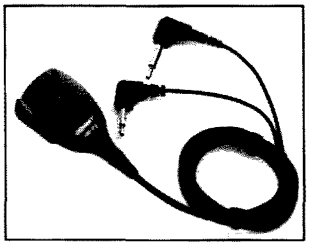
There's a new rig coming soon from Kenwood—the TS-60S 90 watt 6 meter transceiver—and it is designed in the same style and configuration as the popular TS-50S HF transceiver.

Main features include a full 90 watts output on SSB, CW, and FM modes; 23 watts on AM mode; 100 memory channels; Direct Digital Synthesizer with fuzzy logic control; a large LCD panel with a digital bar meter; a multi-function microphone; and much more.

The suggested retail price for this all-mode transceiver is $1,209.95. For more information visit your favorite Kenwood authorized amateur radio dealer or contact *Kenwood Communications Corporation, P.O. Box 22745, Long Beach, CA 90801-5745; (310) 639-4200.*

NCG COMET

With the downsizing of most hand-held transceivers available today, Comet has introduced a fine quality speaker-microphone in a compact size to match. The new Comet HM-P2 may be the smallest speaker-mike you'll ever see, measuring approximately 1" wide by 2" high. The rugged plastic shell houses the feather-light unit, which exhibits excellent transmit and receive quality.

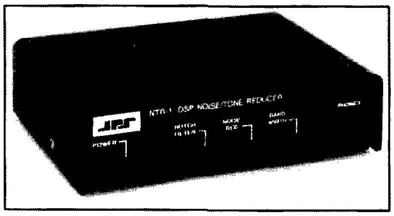


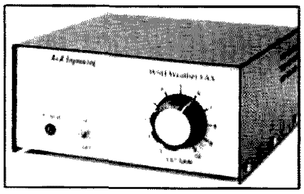
The HM-P2 does everything a comparable large speaker-mike can do and features a dynamic microphone element. The suggested retail price is $32.95 and it is available at most dealers nationwide. For more information contact *NCG Comet Antenna, 1275 North Grove Street, Anaheim, CA 92806; (714) 630-4541; FAX (714) 630-7024.* Or circle Reader Service No. 203.

JPS COMMUNICATIONS

JPS Communications, Inc., has introduced the new NTR-1 Wide Band Noise and Tone Remover to the amateur radio market. The NTR-1 is a general purpose audio processing unit designed specifically to provide noise reduction and multiple tone removal for AM, FM, or other wideband signals, at an affordable cost.

This handy unit uses Digital Signal Processing to provide operating characteristics far superior to those attainable using analog techniques. Both WIDE (approx. 6.8 kHz) and NARROW (approx. 3.4 kHz) bandwidths are provided to give optimum performance for AM or FM signals as well as SSB, CW, or data. For more information contact *JPS Communications, Inc., P.O. Box 97757, Raleigh, NC 27624-7757.* Or circle Reader Service No. 204.

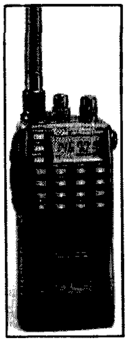




A & A ENGINEERING

Dr. Ralph Taggart WB8DQT has just released his Weather Satellite Handbook Software (WSHFAX) and A & A Engineering has worked with Dr. Taggart to create a compatible interface hardware package. The interface is A & A's Product #200 and is available in kit form or assembled and tested.

This unit is featured in the Fifth Edition of the *Weather Satellite Handbook*. It will process both HF and satellite weather FAX. The software will run on any PC/XT/AT/PS1/PS2 compatible with at least 640K of RAM and one floppy, parallel port, and VGA display. Kit price is $159.95 or assembled for $189.95. For shipping within the USA please add $6.50. For more information contact *A & A Engineering, 2521 W. LaPalma, Unit K, Anaheim, CA 92801; (714) 952-2114.* Or circle Reader Service No. 207.



ICOM

Icom has introduced the new IC-2GXAT hand-held transceiver, with the highest power in its class, along with a multitude of other advanced features at a very reasonable price. This beauty offers simple operation, advanced features and durable construction.

You can operate the IC-2GXAT 2 meter HT by channel number only, if you wish—keeping frequencies secret, restricting frequencies, or simplifying operation for an unfamiliar user. Other features include auto repeater operation, tone scan, DTMF redial, and a user-friendly keyboard.

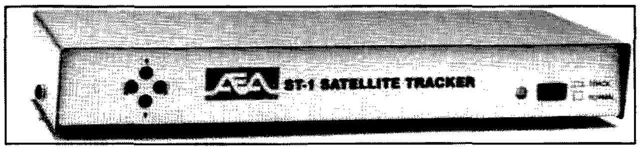
For further information visit your local Icom dealer or contact *Icom America, Inc., 2380 116th Ave. NE/P.O. Box C-90029, Bellevue, WA 98009-9029; (206) 454-7619; Telex 152210; FAX (206) 454-1509.* Or circle Reader Service No. 201.

AEA

Advanced Electronic Applications recently introduced something new for the satellite operator. The ST-1 Satellite Tracker offers the satellite enthusiast hardware and software for the automatic tracking of satellites.

The ST-1 offers hands-off control of antennas and transceiver tuning to make satellite operation easy. As the satellite nears the horizon, the antennas are pointed in the proper direction and the rig is tuned to the right uplink and downlink frequencies. As the satellite moves into the field of view, the antennas track and the transceiver tuning is corrected for the Doppler shift throughout the pass.

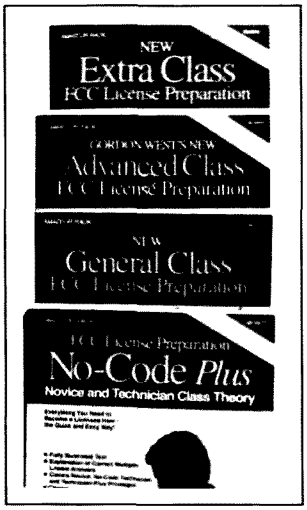
The system has many other fine features, and is priced at $399. For more information, please contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554; FAX (206) 775-2340.* Or circle Reader Service No. 202.

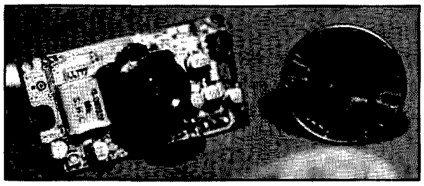


GORDON WEST

Well-known author and *Radio Fun* columnist Gordon West has just finished a four-year project of amateur radio test-preparation manuals with the release of his new Extra Class theory book. "The complete selection of training materials for all radio license grades is a continuous process," said West. "Just as I finish a new book, I go back and begin the yearly revision of another book for the July 1st question pool change."

All of the Gordon West amateur radio license preparation books and code tapes are available from amateur radio dealers throughout the country. For more information or to mail an order, contact *Gordon West c/o the W5YI Group, P.O. Box 565101, Dallas, TX 75356-5101; (800) 669-9594.* Or circle Reader Service No. 205.





SUPERCIRCUITS

Imagine screaming along, just inches off the ground, at 60 mph. Or how about nose-diving straight down from 1,000 feet up, and pulling out at the last moment? The Supercircuits PC-10XS microvideo camera is what makes it happen!

For a really exciting project, try mounting the PC-10XS microvideo camera and a miniature amateur TV transmitter to a model rocket, R/C airplane, car, or helicopter. Live video telemetry can be thrilling and it is easier than you think. The unit weighs in at one ounce, produces a sharp 380 lines resolution, and works well in low light with an auto-exposure control. For more information contact *Supercircuits, 13552 Research Blvd., Austin, TX 78750; (512) 335-9777.* Or circle Reader Service No. 206.

73 Amateur Radio Today

MAY 1994
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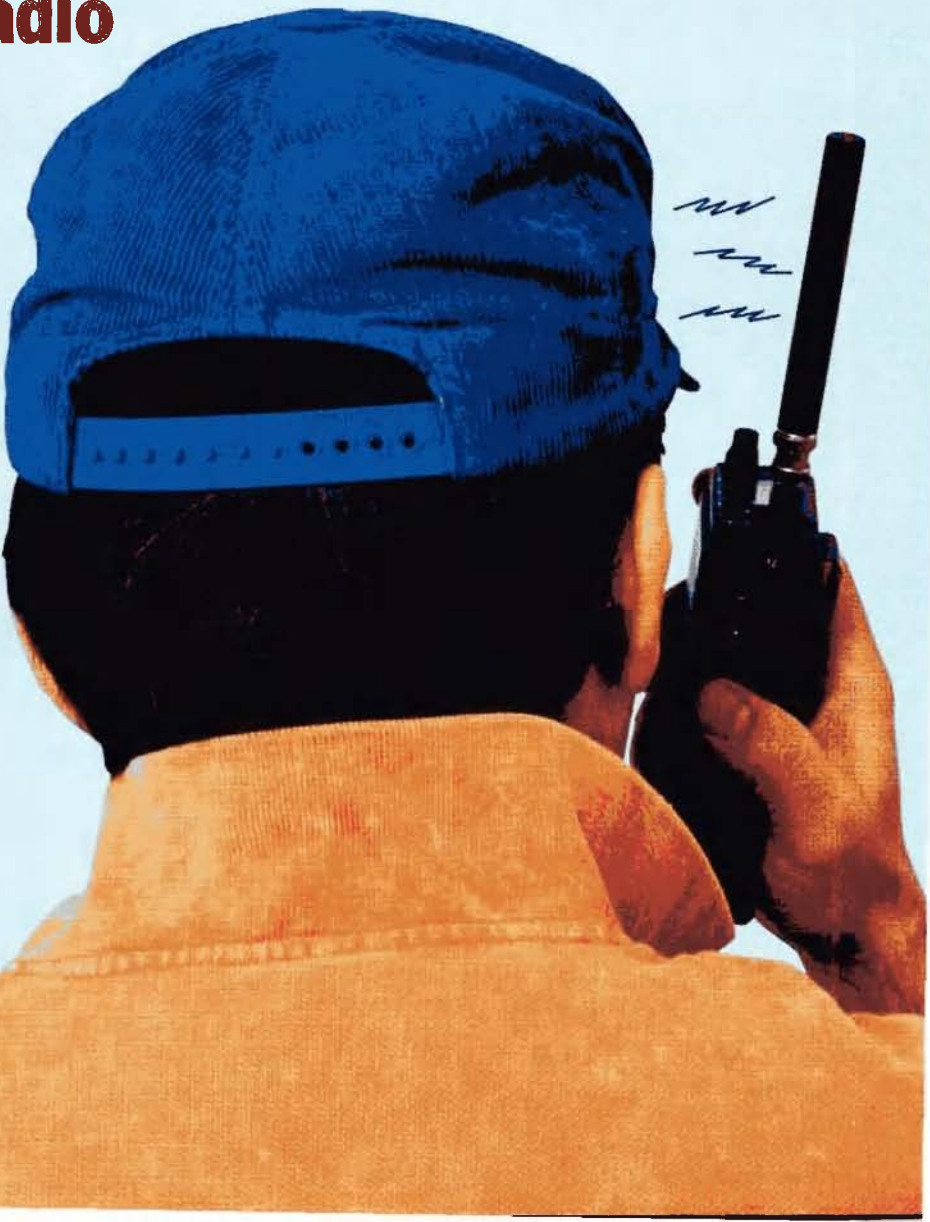
The Truth About Electromagnetic Radiation

is Amateur Radio Killing Us?



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May 1994
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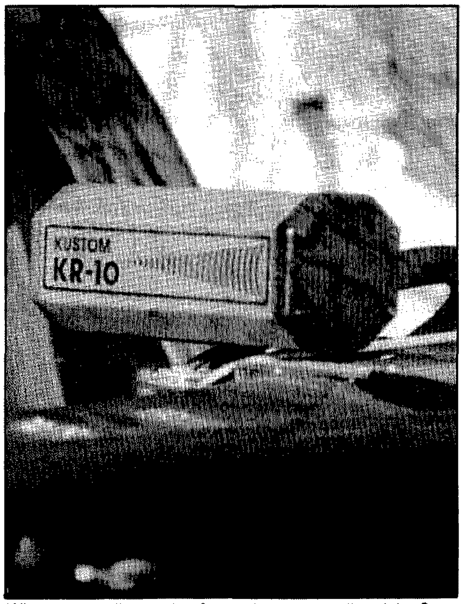

What can spoil your day faster than a speeding ticket? Turn to page 30 and find out.

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Senior Editor Charlie Warrington WA1RZW, demonstrates how close we sometimes are to electromagnetic radiation. Turn to page 30 to learn more. (Photo by David Cassidy N1GPH.)

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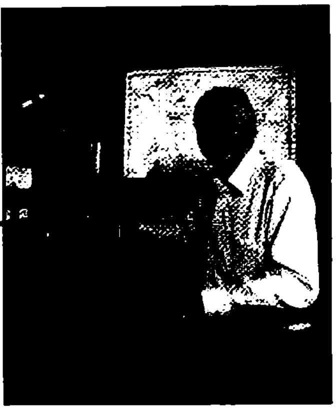
Contract: Since you like *73* enough to read this squinty type, you are hereby ordered to tell your friends. The more readers we have, the more great articles we can bring you!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Wayne at Dayton . . . Not!

The Hamvention chairman helped me make my decision . . . to not attend Dayton this year. I gather that Kenwood or someone more important wanted my traditional Saturday afternoon speaking slot, so they offered me Sunday morning. That's a fine spot, except that my experience has been that at that time I tend to outnumber the audience. The few hams who haven't already started on their drive home are either at church or are busy trying for one last two-dollar discount on a new rig from desperate dealers. It's really lonely on Sunday at Dayton.

There's always a bright side to things. In this case this will give me time to attend (and address) a Learning Technologies conference at New Brunswick Community College, which is the same weekend. They're working on distance learning projects, which I happen to think are the key to getting both the Canadian and American educational systems off the destructive track they've been on. It's easier to provide a whole new teaching system than to change the present one. And, obviously, the financial rewards are almost beyond calculation. There is a built-up need for quality education that will take years to satisfy.

Distance learning? That's via satellite, TV, cable, or videotape. And it can be made fairly interactive. We have over 250 million people in America who need to learn things which could be taught via videotapes. With some small language modifications these will also be good saleable products in Europe for another 400 or so million customers. In the long run this will be an inexpensive way to provide a superb educational product.

A course that will be used by millions of people can cost millions to make and be a bargain. This means we'll eventually be seeing educational videos which feature top performance talent, lots of graphics, and are fun to use. Maybe even exciting. Heck, they might even be more entertaining than some of the stupid sitcoms we have been wasting our lives seeing. Will they be able to compete with basketball games? Probably not.

I'll be sorry to miss saying hello to my thousands of friends at Dayton. I always enjoy that. And while the *73* booth didn't pay for itself in sales, I did enjoy the opportunity it provided for readers to find me and tell me how they don't always agree with my editorials. To which I should not just nod, but should tell 'em that if they don't agree with me, then they should do their homework and then they probably will. I don't shoot from the hip when I'm writing my editorials. I do my homework before I write.

I'll miss those big Hamvention barbecue sandwiches too. Mmm, they're good! What I won't miss for a minute are the crowds which make it almost impossible to get around the narrow aisles. And I won't miss having to stand in line for 10 minutes to say hello to someone in a booth. Or having to park a mile from the arena and walk through the mud to get there . . . and back. Or what seems like the inevitable rain, which further packs 'em into the inside exhibits.

On the bright side, I've been stewing (and writing) about how hamfests haven't changed hardly at all since I attended my first in 1938. Well, I've got what seems to me like a great solution on how to change hamfests so they'll be more fun and help attract new hams. If anyone cares much I'll explain what I have in mind. I think we'll be able to double or quadruple attendance, and at least triple the exhibitors. But hey, if I can think of something like that, why can't you? Give it a try and see what you can come up with.

Hamfests should be growing in popularity, not dying off. I've been disappointed to see one hamfest after another become unprofitable for us to have a booth, and then eventually blow away. I hear the Miami hamfest is a shadow of its old self, but then there hasn't been an original idea there within my memory. The failure of the recent *CQ Magazine* commercial hamfest series tells us it's time for a change. We should have big hamfests every year or two in our major cities. I believe we can, but only if we re-invent them.

Update

Now I see that TNT is going to broadcast a film on Amelia Earhart. Well, they haven't contacted me, and as far as I know, I'm probably the only person alive who really knows the inside story of her last trip. Frankly, I'm disappointed in you. I've written about this and you haven't passed the word. So I watched the recent TV program about Amelia blunder around, and ditto the author of the recent Earhart book. Tsk. Yes, she was a spy for the Navy, and I knew it before she made her trip.

Things have been moving fast in the cold fusion department. The University of Siena, Italy, recently demonstrated a nickel-hydrogen system which generated lots of power and kept on doing it for weeks after all input was removed. It didn't stop by itself, they had to stop it. This is particularly interesting in that the reaction has been at relatively high temperatures (around 500°F), so it's a more efficient system. The estimates I've seen are on the order of 300 kilowatts from three grams of nickel. The university has not been forthcoming on their system for initiating the reaction, but from the pictures my editor took it doesn't look very complicated. This is obviously not a chemical reaction.

Cold fusion presents a wonderful opportunity for experimenters. First, it doesn't cost a bundle to experiment in the field. Second, it doesn't take a Ph.D. in chemistry or physics, or anything else, for that matter. This is a whole new field and there are no experts yet. You could be one, if you wanted. Third, all of the research in this field so far has been empirical, which means everyone involved is trying this and that, and seeing what works and what doesn't.

Pons and Fleischmann got started with this because they'd run across an anomaly that seemed worth checking out when palladium and deuterium were put in a lithium bath. It was much the same with an outfit in Georgia that has been manufacturing steam heating systems that use a new approach to water compression to heat the water. Then their customers started remarking on how efficient their systems were, so they tested one and found it was more than 100% efficient. Hey, what's going on here?

What fields have you become an expert in? For that matter, what have you done with your life that has contributed even a little bit to the advancement of our society? One of the things that really disappointed me when I started going to the reunions of my old submarine buddies from WWII was that few of them had ever done anything of any significance since our time on the submarine. Indeed, that was the most important thing many of them had ever done.

It just isn't that difficult to become an expert in some field. In almost any field. When the microcomputer came along in 1975 I decided I'd have to learn how these darned things work. I went out and bought a stack of books on computer theory and started reading. When I found them difficult to understand (they were terrible . . . college texts), that gave me the idea to start *Byte*. I knew there would be thousands of people in the same fix.

No one knows yet how cold fusion actually works, so anyone new to the field is starting out fresh. Actually, a newcomer has an advantage. One of the things that has hurt cold fusion has been the know-nothing scientists who, because they don't have an explanation for what's happening, have been refusing to believe it. Their position is that every one of the research labs that has claimed positive results has made serious errors. It can't happen. It hasn't happened. Everyone is mistaken. One scientist and one journalist have staked their reputations on this with books they've published.

Amateurs have a great advantage in that they aren't limited by what they know, only by what they don't know.

So the next time you start reading about digital voice, digital data compression, video compression, or a crypto algorithm, don't blonk out your eyes like that stupid old orphan and her even older dog, put on your pioneer hat and head for the hills of learning. How's that for some creative clichés? Blonk that metaphor!

Custom Callsigns

As I've mentioned in a past editorial, I'm enthusiastic about custom callsigns. I thought this was a fine way for the FCC to make some money to offset what we're costing them. So I'm delighted they're now thinking in terms of making 'em available. They're great for club stations, for special events, and for serious ego cases. Like me.

Yes, of course I have a special call in mind. While on the one hand I'll hate to lose my old W2NSD call after all these years, on the other it would be nice to have a really distinctive call.

When I moved to New Hampshire from New York in 1962 I asked the FCC if I could get W1NSD, which had been unoccupied for several years. When I moved to North Carolina in 1948 to take an announcing job at WEEB in Southern Pines, the manager said I would also have to have a broadcast engineer's license. So I took the train to Washington that night and took the license test the next morning. And passed. While I was

Continued on page 90

LETTERS

Number 2 on your Feedback card

From The Hamshack

Ward Stewart VE3FGS, Lakeland FL Wayne, I've been reading your rantings in the December 1993 issue ol *73*. I have a couple ol very quick reports for you.

I bought an Allnco DJ580 HT. I believe that it represents the best value around, and has the usual overabundance of bells and whistles. The receiver audio is really good and is sufficient to drive a commercial mobile speaker. Cutting a jumper gives DC to daylight frequency coverage. Selectivity is as good as can be expected with that kind of bandwidth.

My principal gripe is the smallness of the push-buttons and the readout. The manufacturers seem to forget that most of the hams with the bread to buy this type of equipment have reached the age where bigger is better. Perhaps I'm off base on this one.

The company has an excellent attitude with regard to customer service. They're always willing to listen.

So, you think you're abnormal. When did you reach that conclusion? You make it sound like a burden . . . it's not, and you know it. You can say and do all kinds of weird things and get away with it. It's wonderful to be thought of as abnormal, it's like a license to be free! The downside is that you're seldom taken seriously, with the resulting frustration of knowing that your views are valid, but lack validation by the mob. Console yourself with the knowledge that you at least have a pulpit!

P.S. Anyone with a limited budget who is considering buying a VHF mobile rig should consider this: Spend five or 10 bucks on a good (i.e. Motorola or GE) mobile speaker, and buy an HT instead of a mobile. 200 mW of audio into a good speaker is more than enough for most applications, plus you have the versatility of a mobile plus an HT. Two watts RF output is quite adequate for most repeaters, as you know. Need better coverage? Put your money into a gain antenna.

Dave Buren N2GE, Hancock NH Wayne, I find the issues discussed in the February 1994 "NSD" column immensely more interesting than the usual warmed-over ham radio techie topics. I picked up R. Becker's *Cross Currents* and it is truly fascinating. I especially appreciate your Interesting reading references.

Count my vote to print the schematics for the microamp generator and magnetic pulser. This is exciting stuff . . . sure beats "ARRL Happenings."

Dennis Washer N4EXB/5V7WD, Jacksonville FL Wayne, in following your comments and other articles dealing with the effects of EM fields, I have found it interesting that the medical community is just now starting to wake up to the very real effects of this menace.

I have had the privilege of being reared in Western Africa (Niger). Having been born there and having spent 18 of my childhood years in colonial Africa, I can rarely recall having Africans at the dispensary/hospital with any form of cancer. Some of this may be attributed to a better present-day knowledge of what cancer looks like, but part of this low incidence is also due to a better diet (witness the low incidence of heart problems). More importantly, I believe that the lack of electricity of any form (and its associated power lines, transmitters, etc.) has played a vital role in this. The '70s and '80s brought modernization (rightfully needed), but with it came the generators, transmitters and power lines into even the humblest of mud huts. Is it coincidence that the incidence of cancers ol all types has gone up?

I believe that future research will prove the damage brought about by electricity. But we cannot turn the clock backward and keep everyone in the "savage" years, and so our task as amateurs is to help protect that newly-emerging modern society by continuing our research into ways to safeguard against EM fields. We cannot just roll over and play dead and admit defeat; we must continue to be on the cutting edge!

Thanks, Wayne, for continuing to challenge us with your good magazine.

Camilo Carrau HI3CAZ, Puerto Plata, Dominican Republic I have followed your extraordinary journey through this puzzling and yet wonderful world of ours and sincerely, Mr. Green, let me use this opportunity to congratulate you, thanking God to have at least one Wayne Green incarnate!

I own and direct a small three-year-old television station on the north coast of the Dominican Republic: UHF21 Puerto Plata Television, licensed HICC. In our recent visit to our capital, Santo Domingo, my brother and I purchased the February issue of *73 Amateur Radio Today*. My brother, a physician and director of a rural hospital in our province, and I couldn't wait to return home to write you. Uncle Wayne, we *need* the circuit diagrams of *all* the units you have written about, both the anti-HIV and the other for the cure of drug addiction. Thus, I have decided to use the most expeditious and the Third World's safest way to contact you: the fax.

Please regard this letter as the answer not of a thousand but of millions of souls dwelling amidst ignorance and oblivion on this beautiful island shared with a nation bearing one of the world's highest indexes of AIDS: Haiti.

Rod Hogg KØEQH, Scott City KS Uncle Wayne, there have been many times I have been in agreement with your editorials, and quite a few times I've wanted to bang the table and strongly disagree, but that's history now. As of now, in reading the "Never Say Die" column in the March issue, I have been taken in by your comments on the "light" topic.

Interestingly or not, and you may be aware of it, in the February/March issue of *Modern Maturity* there is an article in the "Medicine" column on the use of light therapy for jet lag, etc., maladies by Stephen Rae. You may not be a member of the AARP (knowing how young you act) and thus you may want to locate a copy and add it to *your info* file.

As I read your column, I thought ol my personal experiences with light, In particular sunlight, and the therapeutic effect it has on me. I recalled a meeting of a Kiwanis club I used to belong to. We had a member, a Dr. Goodwin, who was an optometrist who presented in our monthly program schedule an interesting motion picture (not a video, but a *movie*) on the studies made with light. I think it was the work done by John Olt. II dealt with slow-motion photography and his experiments with various lighting. Then Dr. Goodwin branched off on this with his work with light and learning disorders, in particular with the use of corrective lenses, etc.

What I wonder is, are the bad guys, ones with dark glasses all the time, just bad and getting "badder" because they never get any sunlight on the retina? Seems like all the hoods of the world are afraid of sunlight. Hmmm . . .

Best 73s. I will look for more "inspirational and moving" words of wit and wisdom.

Rod—Thanks for the fax. Yep, I get Modern Maturity. *Yep, I read the article.*

You'll want to read the Liberman book on light, too. Dr. Wm. Campbell Douglass also has a book, Into The Light. *It's $27 ppd. from Second Opinion, Box 467939, Atlanta GA 30346. You'll want to read the Ott book,* Health and Light, *too. Excellent. Cheers . . . Wayne*

Lyman H. Wolfla II K9LZJ, Boise ID Wayne, I have been reading your journal for a number of years now and have tried to at least skim your "Never Say Die" editorials. In the last few months it seems that you have finally moved from rehashing the same old ham radio issues to some new and exciting areas.

Last month I purchased the book *Cross Currents* and dug out my very old copy of *The Secret Life of Plants*. For the past 24 years my career has been in the application of business and technology in the world of medicine. Dr. Becker's book has renewed my interest in neuroanatomy and in the effects of both electrical and magnetic fields on the human body. Thank you for bringing this book to my attention.

As a clinical engineer I have long known the effects of light on the human body. I have always found that the natural sunlight coming in the window of my office/ham shack Is important in starting my morning. Likewise, I do not use sunglasses unless I am flying or exposed to highly reflective light when skiing or sailing. Keep up the good work in helping our amateur population understand the effects of broad spectrum light.

Finally, I am most interested in learning more about your research into cold fusion. I plan to pick up the book *Fire From Ice* this week. Hopefully we will hear more from you regarding this exciting *new* field.

Like you I am getting rather upsel with the "pleasure seeking" attitude of the American public. The advances In information and knowledge do not seem to be Improving the government, or the direction in which it is going. The increase in crime, the generally poor quality of our school systems, and the continued growth of the welfare state is becoming more and more of a concern. Your editorials are refreshing in these areas. Keep up the good work!

James Devlin N5OQV, Newalla OK Wayne, while reading your editorial in the March 1994 issue I ran across one section, with the heading "Politics," that I had to comment on.

Trying to get people to do anything about the way things are going in *our* government is next to impossible. I sit there at work and listen to everyone complain about everything from taxes to crime. Try telling them to write or organize and try to do something about it and all you hear is "Well, it won't do any good," or "I don't have time." So I tried running off some letters on my computer thinking maybe they'd at least mail them to their representatives, but that didn't work either. I guess they don't want to spend the 29-cent postage.

I joined the United We Stand group right at first. I mailed in my dues, got two petitions to sign and last month I got my renewal notice telling me how much good they were doing. Needless to say, I've still got my dues.

Anyway, I just wanted to say I definitely agree with your statement, "When we refuse to try and do something to solve our problems then we are condoning them." I don't know what the solution is but the people had better start doing something besides complain or the country of our grandchildren will not be anything like what it has been to our parents.

QRX . . .

Number 3 on your Feedback card

AMSAT 3-D Video

The Radio Amateur Satellite Corporation (AMSAT) has launched a publicity effort to ensure adequate funding for completing ham radio's newest, largest, most complex, and most expensive satellite ever. The nonprofit group recently enlisted the help of retired Senator Barry Goldwater K7UGA (see photo below) in producing an AMSAT 3-D informational video.

The one-quarter scale 3-D model seen in the photo was handmade by Stan Wood WA4NFY and appears in the video presentation. The production is narrated by former NBC Science Correspondent Roy Neal.

The new Phase 3-D video may be borrowed at no charge by sending a self-addressed 7-1/4" x 11" bubble-cushioned mailer and $2.90 US postage to AMSAT-NA, PO Box 27, Washington, DC 20044. It may be just the thing to liven up your next club meeting. Borrowers are encouraged to make their own copies of this video to help promote the project, which is due to be launched in 1996. *TNX Keith Baker KB1SF, V.P. for Strategic Planning, AMSAT.*

Keep Off My Machine

The FCC has issued a letter of interpretation that validates the authority of repeater system licensees to ban duly licensed radio amateurs from operating over their open repeaters. The letter comes in response to a request for clarification sought by Attorney Sidney Radus N6OMS of Orange, California. Radus is representing the Claremont Amateur Repeater Association (CLARA) in its fight to regain control over the way its club repeater systems are used and by whom.

The Commission's Personal Radio Branch Chief John B. Johnston W3BE clarified Section 97.205(e), which states "... Limiting the use of a repeater to only certain user stations is permissible." Johnston wrote, "The rule section applies whether a repeater is coordinated as an 'open' or 'closed' repeater. Further, the rule applies without regard as to whether a repeater is coordinated at all. Rule 97.205(e), without qualification, permits the individual responsible for proper operation of a repeater to limit the use of a repeater to certain user stations."

A man described as a "disgruntled former member" of the CLARA ham radio club was ordered by a civil court to stay off that organization's repeaters or face incarceration. The three-year restraining order is said to be an unprecedented action. *TNX Westlink Report, No. 667, February 28, 1994.*

Getting Warmer

Superconductor research at computer giant IBM has reached a new temperature milestone. But, scientists are still a long way from creating room temperature superconductors.

Superconductors may someday revolutionize electronics and electrical power distribution systems. The goal is to create practical "perfect" conductors—materials having no resistance. Experimental prototypes have only worked in extremely cold environments until now.

Officials at IBM say they have created the first thin films of the mercury-barium-calcium-copper-oxide high temperature superconductor (HTS) that have zero resistance. Previous HTS demonstrations have needed bulk material or used thin films but exhibited some resistance. *TNX Electronic Engineering Times, Issue 788, March 14, 1994.*

Space is Limited

At one time or another, you probably have been advised to "Buy land, 'cause they ain't makin' any more." Well that same wisdom applies to radio spectrum and hams are lucky to have such a big chunk.

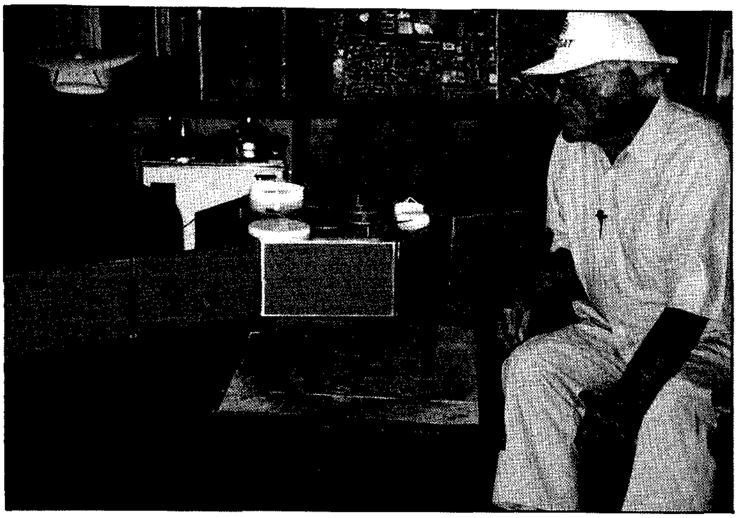
That notion was a key part of the remarks delivered by FCC Private Radio Bureau Chief Ralph Haller N4RH at the recent Tropical Hamboree in Miami. Haller said, "You are fortunate that there are many advances in technology that have helped to improve spectrum efficiency or else we might literally be out of spectrum today." Haller said the new Special Mobile Radio (SMR) band will be up to 40 times as efficient as today's analog FM technology. *TNX Westlink Report, No. 667, February 28, 1994.*

A Nickel for Your Thoughts

Reading minds via computer remains firmly in the realm of science fiction, but it may not seem so far-fetched anymore. Several years of improving athletes' performance using neurofeedback techniques has given Richard Patton special insight into brain-wave pattern analysis using desktop computers. Patton's new company, Advanced Neurotechnologies Inc. (ANI), is leveraging that expertise in a radically new approach to neurofeedback training.

By combining Motorola 56000-based DSP hardware with special DOS-based BrainLink software designed to capture and analyze electro-encephalogram (EEG) patterns, ANI has created a breakthrough brain wave-to-computer interface. The possible implications of this new technology are profound.

With BrainLink software, users can generate alpha, theta, and 40 Hz arousal states to initiate commands in much the same manner as they would use a speech-recognition system to input voice commands. Thus, you may soon be able to operate a wide variety of electronically controlled devices by merely using your head. *TNX Electronic Engineering Times, Issue 786, February 28, 1994.*



Senator Barry Goldwater K7UGA (Retired, R-Arizona) looking over WA4NFY's model of the AMSAT Phase 3-D project at his Scottsdale ham shack. (AMSAT-NA photo by Keith Baker KB1SF.)

TNX . . .

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HI-PER Audio Filter

This project provides HIgh-PERformance CW filtering.

by David Cripe KC3ZQ

I've been watching with interest the proliferation of new audio filters utilizing Digital Signal Processing which have appeared lately on the ham radio market. Even though I'm all in favor of progress, I would really prefer to see products that the average ham could build for himself if he had the parts, or troubleshoot and fix if he had to. DSP can, without a doubt, provide some incredible improvements in performance of audio filters. However, not too many home-brewers have DSP chips laying about in their junk boxes, whereas a lot of us might have an LM324 or two. I contend there is still a lot of life left in the simple, lowly op amp!

I set out to design an active CW filter that would knock the socks off of any previously-published active filter design: one that could give a DSP design a run for its money; one that Joe Ham could build in a weekend and would cost less than a new set of finals for an FT-101.

Why mess with another active CW filter project? Well, the subject of CW filters is one in which the final page has yet to be written. Better CW filtering is one thing most hams wish for. For example, one of the more popular ham projects to come along in recent years has been the direct-conversion QRP rig. These rigs have the advantage of being simple, inexpensive, and easy to build. However, the direct conversion receiver cannot distinguish between upper and lower sidebands, so QRM can be a problem. The addition of good, sharp CW bandpass filtering to the direct-conversion receiver goes a long way to improving the usability of the rig, making it more practical for use in high-QRM situations.

Many commercial rigs suffer from poor CW filter designs which are either too broad, or suffer from excessive ringing. A good audio CW filter would be useful in these cases, as well. Many of the early SSB rigs had only a single-sideband IF filter, and no CW filtering. Finding a crystal CW filter for these antiques is by now nearly impossible. One example would be my old Heathkit HW-100, whose lack of a CW filter further motivated me to design my own!

Most active CW filter designs published so far have been really simple, utilizing one or two op-amp sections. If the bandwidth of these filters is made as narrow as that of a good CW crystal filter, they suffer from ringing, which tends to smear the transitions between the CW pulses and the spaces separating them, affecting the intelligibility of the CW characters. In order to achieve the maximum performance from the receiver, we must design a filter which has both a narrow bandwidth and minimal ringing.

In setting out to design the best active CW filter, I had to first discover the characteristics that made a good bandpass filter. While researching the subject of bandpass filters for CW reception, I discovered that there was far more to filter design than just throwing R's, C's and op amps at the problem. Apparently, the ringing one experiences in a poorly-designed CW filter comes from the phase response the filter possesses, rather than its amplitude response. Within the passband of the filter, the filter's phase shift versus frequency must possess a constant slope for the filter not to ring. The all-important slope of phase shift versus frequency is referred to as "group delay." A filter designer concerned only with designing a CW filter with a narrow amplitude response is likely to miss the requirement of constant group delay, ending up with a filter design that rings like a church bell. However, I found that a family of bandpass filters possessing the required flat group delay had been discovered by Blinchikoff [1]. These filters are optimized to possess minimal overshoot and ringing, and are ideal for this application.

Even with flat group delay, a minimum filter bandwidth is required for intelligibility of the code characters. Even though the information contained in 20-word-per-minute CW is concentrated mainly in a 25 Hertz bandwidth, without the addition of frequencies contained further away from the carrier, the CW signal sounds mushy and the characters are hard to distinguish. But, as one widens the CW filter to improve signal intelligibility, we increase its susceptibility to interference from close-by QRM. For this design, I chose a 200 Hz bandwidth as a compromise.

Figure 1 shows the filter topology and values of a passive version of this filter, 200 Hz wide, centered at 700 Hz. I have modified Blinchikoff's original design, adding a notch to the response at about 1600 Hz to sharpen the high-side QRM rejection of the filter, while leaving the filter's group delay essentially untouched.

Figure 2 shows the schematic of an active implementation of this filter. It uses its op amps in a configuration known as a "Generalized Immittance Converter" [2], (GIC), which allows the creation of active networks which simulate inductors, capacitors, etc. Unlike other active filter topologies, such as the Sallen-Key, with the GIC it is easy to make the conversion between a passive and active filter design. The schematic may seem complicated, but with careful layout and construction the circuit may be fabricated onto a few square inches of PC board which can be mounted inside most rigs, or outboarded in a separate box. The design here uses 12 op amps, which are contained in three 14-pin ICs. Despite the number of ICs, it won't blow the power budget of most QRPers, as the filter circuit consumes only about 10 milliamps. Although designed to run from 12 volts, the filter circuit will also work well from a 9 volt battery. The circuit does not require a split supply; the circuit containing op amps U1d and U3b provides a bias voltage in the middle of the supply voltage.

The filter circuit uses 1% tolerance resistors, as well as 0.022 µF capacitors, which must be fairly closely matched: 5% or better tolerance is preferred. These parts are available through sources such as Digi-Key or Mouser. The circuit can be assembled on a Radio Shack solder-pad perf board #276-168A or, better yet, on the custom PC board shown in Figure 3.

I have included a filter bypass relay K1, which can be used to switch out the CW filter when the operator wishes to return to SSB opera-

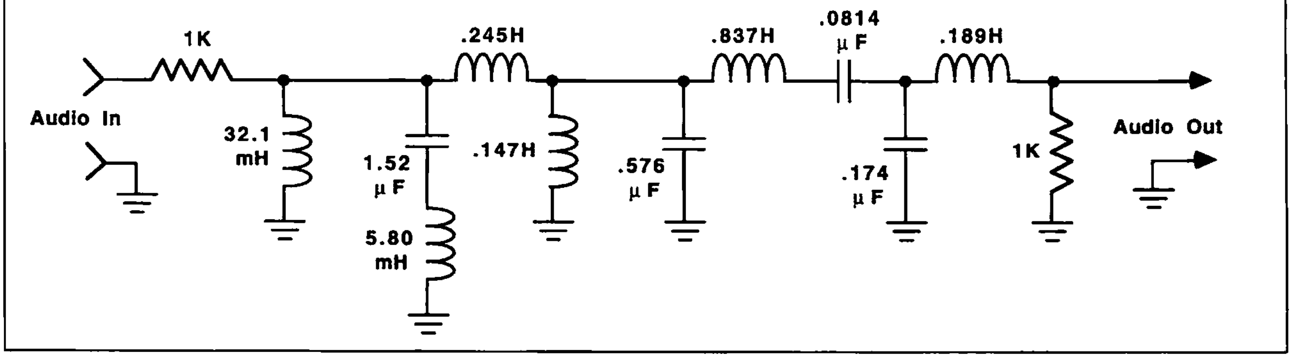

Figure 1. A high-performance passive filter. The center frequency is 700 Hz; -3 dB bandwidth is 200 Hz. Notice there are no standard values here.

HI-PER Audio Filter *Continued from page 10*

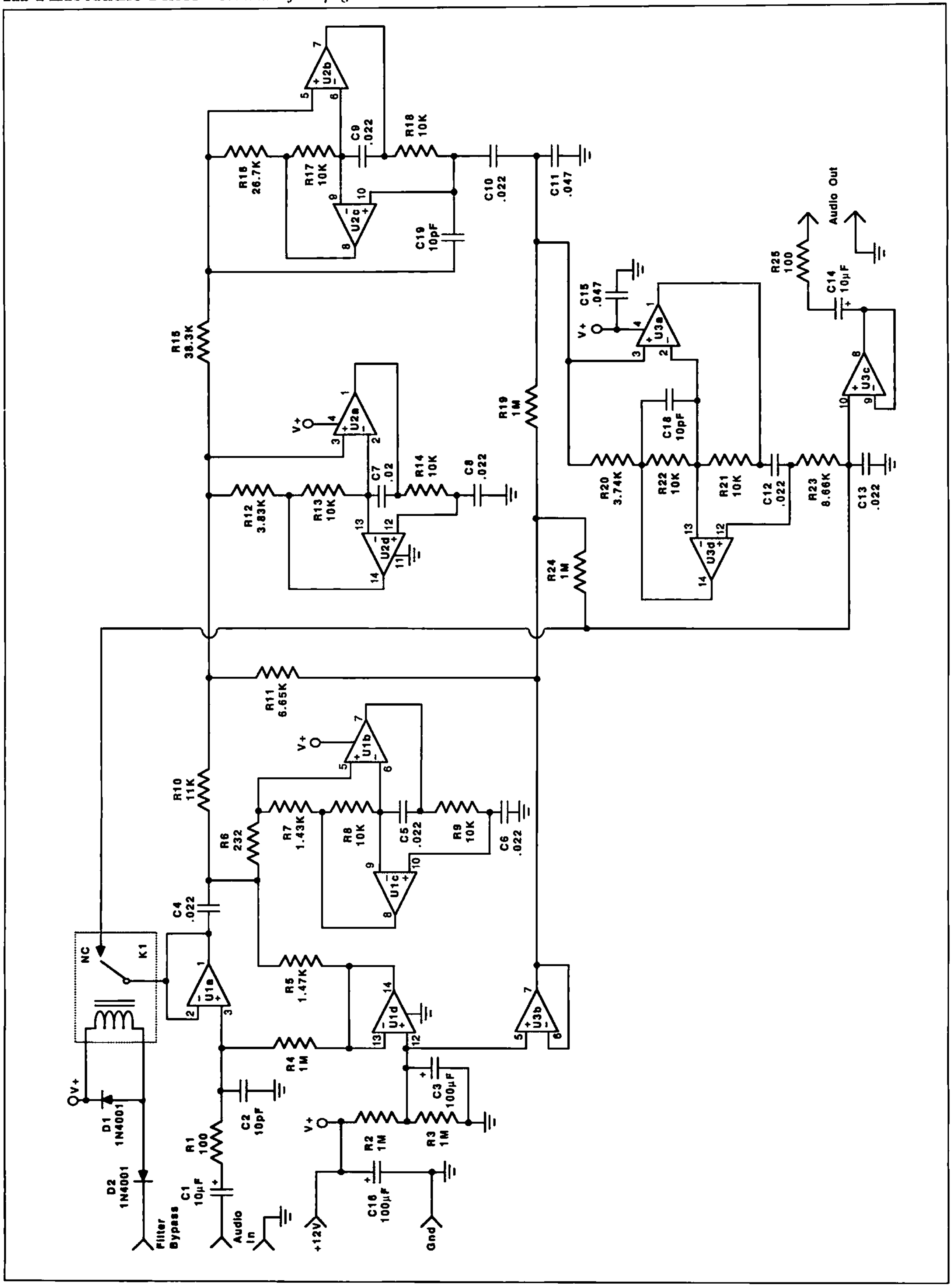

Figure 2. The active version of the high-performance audio filter.

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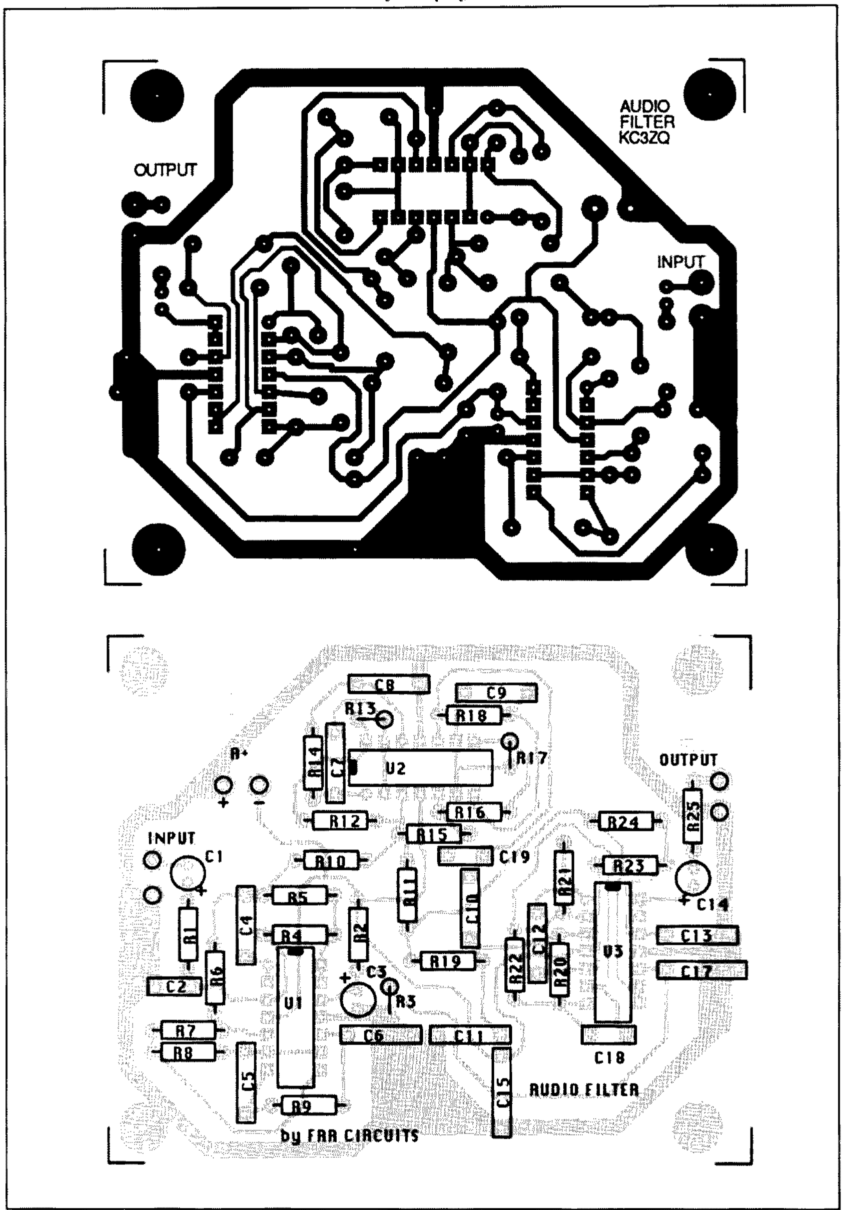


Figure 3. A drilled and etched PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4.50 plus $1.50 S&H per order.

tion. To activate the CW filter, a switch or relay contact within the rig must pull one terminal of the bypass relay to ground, opening the relay contacts. Those wishing to omit this feature, and operate the filter continuously may simply delete K1 and the diodes associated with it, D1 and D2.

Electrically, the filter should be mounted between the first and second audio stages in your rig. Use shielded wire to connect to the filter to help reduce RFI effects.

In operation, the performance of the filter is, in short, breathtaking. This is not your garden variety active filter here! In a noisy, interference-filled band, when the filter is switched in, everything but the desired signal falls away. After I installed this filter in my HW-100, I would have been hard pressed to distinguish between its performance and that of any of the best crystal CW filters in any other rig I have used. The lack of ringing in this filter made it better than quite a few other filters, crystal or otherwise, that I have used. This filter should give the same kind of performance to your direct-conversion rig, too.

I hope you enjoy this project, and find as much pleasure in its use as I did in its design. See you on the bands.

References:

1. Blinchikoff, H. and Zverev, A., *Filtering in the Time and Frequency Domains*, 1976, John Wiley and Sons, pp. 199-204.

2. Downs, Rick, "Vintage Filter Scheme Yields Low Distortion in New Audio Designs," *EDN*, November 7, 1991, pp. 267-272.

Parts List

R1,25	100 ohm
R2-4,19,24	1 meg
R5	1.47k, 1%
R6	232 ohm, 1%
R7	1.43k, 1%
R8,9,13,14, 17,18,21,22	10.0k, 1%
R10	11.0k, 1%
R11	6.65k, 1%
R12	3.83k, 1%
R15	38.3k, 1%
R16	26.7k, 1%
R20	3.74k, 1%
R23	8.66k, 1%
C1,3,14,16	100 µF electrolytic
C2,19,18	10 pF
C4-10,12,13	0.022 µF 5%
C11,15,17	0.047 µF 5%
U1-3	LM324 or equivalent quad op amp
D1,2	1N4001 or equivalent
K1	12 volt SPDT relay, RS# 275-241

Speech Compression

Make a monster mike!

by Michael Jay Geier KB1UM

If you operate on a crowded band like 20 meters, you know that sometimes being heard can get tough. You hear the other station pretty well, but the QRM wipes you out on his end. Or, perhaps, you're on 10 meters and the QSB and generally poor conditions make it hard for anyone to hear your signal. You've got a good antenna and as much power as you can muster, so what can you do about it? Who ya gonna call? Why, Speech Busters, of course!

I'm referring to speech processing, one of the most valuable signal improvements you can make to an HF transmitter. It's valuable because the sounds made by the human voice have a particular characteristic that makes them hard to send over noisy channels.

Voice signals encompass a fairly large dynamic range. The loud sounds are really much louder than the soft ones, and there are far more soft ones than loud ones. As a result, the *average* level is way below the *peak* level. That's no problem in a nice, quiet room. And, in face-to-face contact, lip movement, facial expression and other visual cues help us fill in the blanks when sounds get lost in busy environments. On a noisy radio channel, though, the result is a mess. Without the other cues, we lose some sounds, making words harder to understand. In other words, our *intelligibility* suffers. Compounding the problem is the fact that, because the peak voice level determines the transmitter's peak power output, the *average* power output is fairly low; we're wasting a lot of our transmitter's capability. We need more "talk power." Enter the speech processor.

The function of the speech processor is to equalize the volume levels between the normally softer and louder sounds. Yes, it's a kind of distortion, but it's one that helps make the words more intelligible, even if the resulting voice quality is not as natural-sounding. The process is fairly simple: You raise the level high enough that peaks are clipped off and softer sounds are closer to the level of the now-clipped peaks. Then, you filter out all the ugly distortion you just created with the clipping by passing the signal through a narrow-bandwidth filter. Voilà, processed speech.

You really can do it that way, but it sure is hard to do at the audio level. Why? Because making a steep filter that will remove all the clipping mess but pass the desired audio frequencies is rather hard at such low frequencies. But, why not bump it all up to RF and do it there, using common crystal or ceramic filters for the cleanup gig? That's exactly what happens in an RF speech processor.

Most of today's HF rigs have RF speech processors built right in. No doubt about it, RF processing is the best kind, especially since you never need to convert the result back to audio with an internal processor. All you have to do is feed the processed RF through the sideband filter and then into the rest of the transmitter's stages. What could be easier?

If, however, you have an older rig, or you have one of the less expensive modern rigs, like my Yaesu FT-747GX, you may not have a speech processor. And, you may spend a lot of time rationalizing why you hear others so much better than they hear you. Is there a way out?

You betcha! At one time, outboard RF speech processors were available, and they worked fairly well. A good example of such a product was the Daiwa RF-440. Of course, the RF processing method is fairly complex, so these boxes weren't cheap. And, since there was no access to the radio's transmit IF stages, it was necessary to reconvert the processed signal back to audio in order to get it into the rig. But it worked, and it sure beat having no processor.

Nowadays, with most rigs having their own processors, outboard units are not very common; there just isn't enough market for them. But speech processing doesn't *have* to be done at RF. It can also be done right at the audio level. As I mentioned before, the clipping process creates problems that are hard to resolve at audio frequencies. Luckily, there's another kind of processing that doesn't involve clipping at all, and it lends itself well to simple audio circuits. It's called compression.

Squeeze Play

The object of the game is to reduce the dynamic range of the voice signal, right? Doesn't that sound similar to the function of a receiver's AGC circuit? AGC adjusts the receiver's gain to reduce the apparent dynamic range of incoming signals. Sounds like the same idea, right?

It is! And, it's not. AGC stands for Automatic Gain Control, and that's what it does: It controls the gain of the receiver to keep signal levels as constant as possible. Such a technique might be called "volume leveling." The big difference between volume leveling and speech compression is the speed at which it occurs.

Similarly, if you've ever tried to compensate for lack of a speech processor by deliberately overdriving your mike gain and relying on the transmitter's ALC to compress the signal for you, you know it doesn't work. On the air, you sound about the same as if you backed the gain down, at least until the point at which your rig begins to distort and splatter. Why doesn't it work? For the same reason a receiver's AGC doesn't compress speech: The ALC just isn't fast enough.

If you look at a voice signal on an oscilloscope, you'll see that the various sounds in a spoken word occur rather quickly. The time difference between the peaks and softer levels can be as little as 100 milliseconds. Syllables go by at maybe 300 milliseconds. AGC and ALC circuits, though, operate at speeds of perhaps one or two seconds. To be more accurate, I should say they *decay* at that rate; most attack very fast. In other words, they clamp the gain down very quickly, but it takes quite a bit of time for them to open back up.

Why doesn't AGC work faster? Well, if your receiver has a control that lets you set the AGC to "fast," you'll find out! Try it and you'll see that people's voices do sound compressed, but all the background noise, static and QRM also "pump" up and down, making it hard to listen to. It'll give you a headache real fast. That's why the process must be done at the transmitter. As for transmitter ALC, it could be made to be faster, and it would indeed act as a speech compressor. But, there's a big drawback which prevents rig makers from doing it that way: It takes a finite amount of time for the circuit to act, resulting in some overshoot (delay in clamping) on voice peaks. It isn't practical to filter out the resulting distortion and splatter in a 100-watt signal, because such narrow filters must be made from crystals or ceramics, and they can only handle small amounts of power. So, ALC-based compression generally is out of the question. I believe, how-

Continued on page 18

Speech Compression

Continued from page 16

ever, that Drake used to have a rig with fast ALC for speech processing use. Also, there's a new linear amplifier which does it, too. So, I guess it can be done, but it isn't common.

So, we're back to compressing the audio before it goes into the transmitter. There have been many circuit designs published, and various commercial products, which do the job. I've tried building a few compressors, and I've played with a few commercial boxes, and even bought one, but none of them really made much difference on the air. In fact, it was always hard for the receiving station to tell whether I had the darned thing on or off! Why?

It's the same old problem: The things operate too slowly. They make lovely volume levelers, but they don't actually compress speech at the syllabic rate, which we need if we're going to increase our talk power. Here's what happens when you use most audio compressors: The first loud sound in a sentence clamps the gain down, where it stays pretty much permanently, because, by the time it starts to open back up, other loud sounds have clamped it down again. The softer syllables in between the loud ones never get cranked up, so there's no increase in talk power. For a compressor to increase talk power, *it must have time constants which are as fast or faster than the syllabic rate of speech.* That way, it can open the gain back up for the softer syllables, thus making their levels closer to those of the now-clamped peaks. That's *real* speech compression, and it does indeed up your talk power! On a scope, the output of the rig looks similar to what you get with an RF processor.

The Monster Compressor 85

I recently purchased a Kenwood MC-85 desk microphone. This lovely unit has a condenser mike, switch-selectable outputs for three rigs, and a built-in volume-leveling compressor. Almost all of Kenwood's newer HF radios have internal RF speech processors, so the volume leveling approach is a nice complement to what's inside most of the rigs to which this mike is likely to be connected. (A syllabic-rate compressor feeding a speech processor would be *extreme* overkill.) But I got my MC-85 for use with my processor-less '747GX, so I decided to try and modify the mike's compressor into a true syllabic-rate speech compressor. The mod works like gangbusters.

Charge It

Imagine, if you will, an amplifier whose output signals are inverted and then fed back to a terminal which controls the amplifier's gain. As the output signal rises, the gain is pulled down. And, as the output falls, the gain is increased. Sounds like a compressor, right? Well, all except for one thing: If the control terminal is moved up and down as fast as the waveform coming from the amp's output, the result will be that the output signal completely disappears! It makes sense; each swing of the output cancels itself out. The way around this is to slow the loop down. As long as the loop cannot alter the amp's gain anywhere nearly as fast as the output signal swings, it won't wipe itself out. To that end, there's always a capacitor in the loop. Together with a resistor or two, that capacitor forms a *time constant*, preventing the loop from being too fast.

The primary modification to the MC-85's circuit involves changing the time constant in the feedback loop, making it just fast enough to catch spoken syllables. A few other changes also are necessary because of peripheral consequences of the change in the loop.

How It Works

Take a look at Figure 1. IC1 is the amplifier. The input is through pin 2, and possibly also pin 6. It isn't clear from the schematic, but it also doesn't matter for our purposes. What does matter is that the output is from pin 8, and the loop starts at the junction of C11 and C12. The output signal is fed through R13 to the base of Q2, which inverts it. C13, at the transistor's collector, removes the DC component, leaving an AC signal which can be rectified by D4 and D5. The rectified signal charges C14, which is the magic capacitor that sets the time constant. It is important to recognize that, because of D4, the capacitor cannot *discharge* back into the transistor. That feature lets the processor's attack and decay times, which are determined by the capacitor's charge and discharge rates, be determined separate from each other. As originally designed, the attack is quick because R17, between the transistor and the capacitor, is small, permitting a

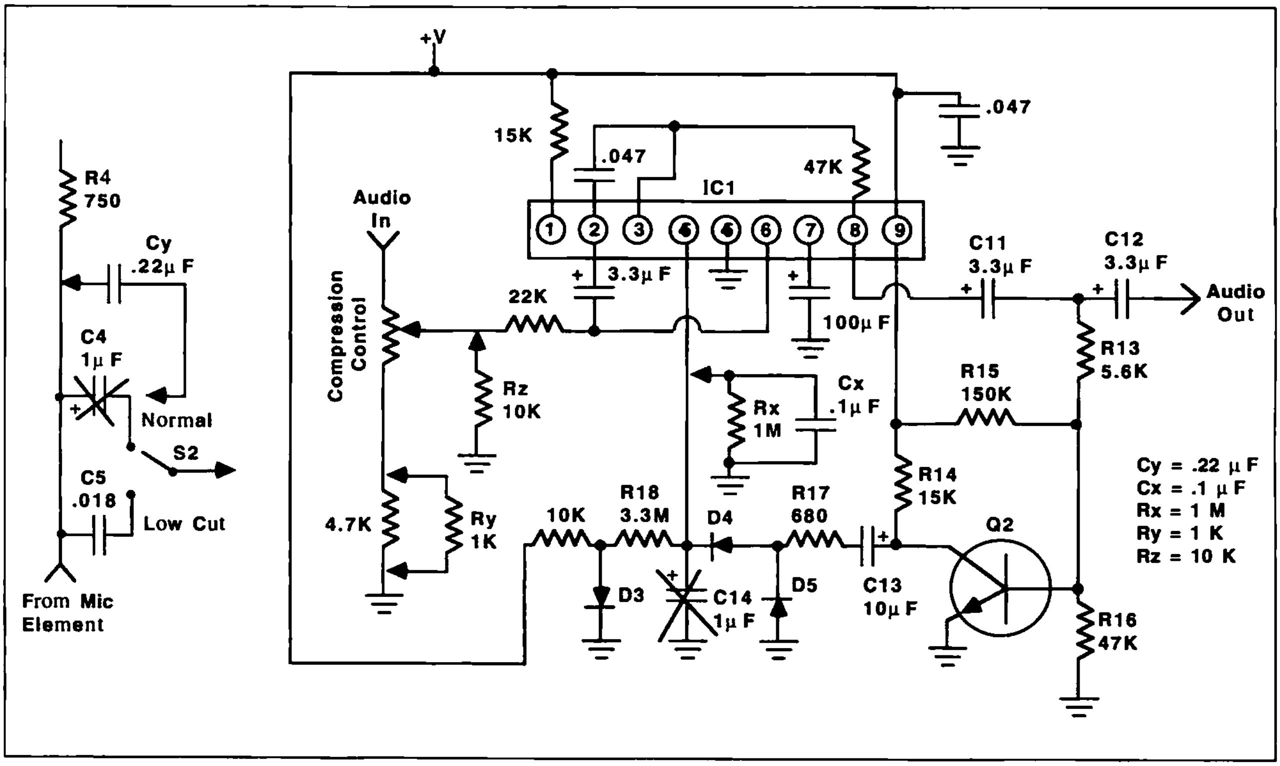


Figure 1. The Monster Compresser 85. Schematic shows modification to Kenwood's MC-85 Desk Microphone.

comparatively large current to flow. (We're still talking about maybe 0.3 milliamps here!) But the cap can only discharge through two places: the amp chip's gain control terminal itself (pin 4), and the R18/D3 combination. The amp chip has very high input impedance, so it can be disregarded. But, take a look at R18, which allows the cap to discharge to ground through D3. That resistor is 3.3 *megohms*, which ain't small change either! The result is that the cap discharges quite slowly, accounting for the compressor's slow decay time.

That decay time is precisely what we want to speed up. So, it would seem logical that we could simply reduce the value of R18. It should work, but, when I tried it, the results were poor. In order to get it fast enough, the value had to be so low that it divided the voltage down to less than what the chip could sense. So, I decided to reduce the size of the cap. After some experimentation, I wound up with a 0.1 µF cap in parallel with a 1-meg resistor; that combination yielded a time constant that sounded about right; syllables were getting boosted, but distortion was acceptably low.

Distortion?

Remember what I said before about the output's disappearing if we allow the loop to be too fast? Well, think of the loop as a low-pass filter, which really is just what it is. If we don't slow it down enough, low audio frequencies will get through and begin to cancel their counterparts in the output, and that means distortion. It gets worse: In this design, Q2 is not operated as a linear amplifier. It is biased to be a pulse amplifier, and it produces pulses which correspond to the peaks in the amp's output signal. Residual pulses being fed back to the amp cause terrible distortion, so they must be kept very low. That requirement resulted in my having to choose the time constant very carefully. Too fast and it sounded awful. Too slow and it didn't accomplish anything!

Uh Oh

After I found the right time constant, I discovered that the overall gain of the circuit had gone way up. Apparently, the DC path of the 1 meg resistor increased the chip's gain. Not having a diagram of the interior of the chip, I can't tell you why. With the gain so high, turning the compression control up past 6 or so caused the entire circuit to go into oscillation! The solution was easy, though. Resistors Y and Z tailor the input gain such that the circuit remains stable. Even with them in place, the compression control doesn't need to be turned up past about 3.

One Last Detail

Male voices contain most of their energy at fairly low frequencies. Also, the gain of the circuit goes up somewhat as the input frequency goes down, exacerbating the problem. The result was that, with the NORMAL/LOW CUT switch (S2) in the NORMAL position, it still was possible for some instability and oscillation to occur. I noticed that the audio was a little bassy anyway, so I changed C4 from 1 µF to 0.22 µF to provide additional low-frequency rolloff. Finally, everything worked great, and the audio sounded excellent.

Let's Do It

Unscrew the bottom of the housing and then unscrew the sides. With the mike facing down (the foil side of the board facing you) and the output cord (or cords) facing away, the SIP (single inline package) IC1 is near the bottom left edge. You'll have to turn the board over to see it, of course. The clipped corner or engraved dot of the chip denotes pin 1. Depending on your dexterity, you may need to unscrew the PC board frame from the rest of the housing, but it is possible to do the mod without doing that. Either way, find C14, a small electrolytic, which is connected between the IC's pin 4 and ground, and remove it. Install in its place a 0.1 µF cap in parallel with a 1 meg resistor. I put mine on the foil side of the board, simply because it was easier to install. Functionally, it doesn't matter.

Now, look over toward the bottom right and find the compression control's connections. When connecting the 1k and 10k resistors, use the ground foil on the left, not the one on the right; the one on the left is closer to the amp circuitry and less likely to introduce ground loop or RF feedback problems. Solder the resistors in place on the foil side.

Finally, you must remove C4, which is another electrolytic. It is located just under the cover, on the component side of the board, which is part of the button assembly. The cap is right on the edge of the assembly, and I was able to remove it with tweezers after desoldering the leads with removal wick. If you can't get the cap out that way, you will have to unscrew the button housing. Be careful not to lose anything! Once the cap is out, replace the assembly if you had to remove it. Now, solder a 0.22 µF cap in its place, but on the foil side of the board. Most likely, a cap of that value will be too big to fit under the button housing anyway.

Finished

That's it! Close it all back up again and you should be in business. Turn the mike on, select COMP IN and speak about a foot away from it. The level meter should look a lot more energetic than it used to! I find that a compression control level of about 3 works fine. Any more than that and it sounds overcompressed.

The Caveat

Be warned: This thing will run your rig a lot harder than it ran without it! Your finals will heat up much faster. On my FT-747, the fan never used to come on during voice operation, but it sure does now. That extra heat, of course, means increased average transmit output level, which means extra talk power!

On the Air

Although the NORMAL position works fine, I find that with LOW CUT on there's more punch. As for the compressor, on-air reports indicate that the difference between turning it on and leaving it off is like night and day. And I've gotten several unsolicited comments on how great the mike sounds. Enjoy your Monster Compressor 85!

P.S.—Recently, I began to have RF feedback trouble with my modified MC-85. I traced it to a poor connection between the gooseneck and its base, which results in reduced shielding of the mike cartiridge. It probably was always like that, but adding strong compression made it appear much worse. If you run into this, check the resistance between the setscrew on the mike element housing and the frame holding the PC board inside the unit. If its more than about 0.1 ohm, you've found the culprit. (Mine was about 10 ohms!) Unfortunately, the metals used at the critical junction won't take solder. I fixed mine with two small hose clamps and a piece of ground braid, after first sanding the connection points. It works, but it aim pretty. For nicer looks, you could drill a small hole in the base and insert a set screw for a good connection, just as long as you're careful not to go through the gooseneck and damage the cable. My mike works great now.

Fast Charger

Recharge NiCd and NiMH batteries in as little as 30 minutes.

by Richard Togashi KN6PK

Why another NiCd battery recharging article? Well, Fast Charger will not only recharge NiCds, it will fast charge them to the correct capacity in as little as 30 minutes. After fast charging, the circuit will then automatically switch to trickle charge. Any number of cells can be recharged, up to a maximum of 16 cells. Programming jumpers allow different charging rates and different cell counts without any circuit modification. And with a single part replacement, the circuit will charge the new Nickel Metal Hydride (NiMH) batteries.

NiCds are a proven technology in batteries, relatively inexpensive, available in all popular sizes, easy to use and easy to abuse. NiCds, when fully charged, exhibit a decrease in battery output voltage. Fast Charger detects this voltage change during fast charging to ensure the batteries are at full charge capacity. After a full capacity charge, Fast Charger will revert to a trickle charge state, allowing the batteries to be at a full charge state indefinitely.

NiMH batteries are a little different; they are an emerging technology. They are similar to NiCds, but they boast higher current densities than NiCds and there is none of the memory effect NiCds are prone to. There are some drawbacks to the NiMH, since it is a new technology: They are in short supply, are available only in limited sizes, are more expensive, self-discharge faster, and have approximately 80% of the recharging cycles found in NiCds. For high current demand or cyclic applications, NiMHs may be a better choice than NiCds. NiMH batteries require a different recharging scheme. They exhibit a voltage plateau when they are fully recharged. By interchanging an inexpensive IC with a similar device, Fast Charger will be able to detect the NiMH recharging characteristics. This will also allow the NiMH batteries to be charged to the full capacity in a minimum amount of time.

Normal battery chargers charge the batteries at C/10 (where C = capacity) with a constant current for approximately 16 hours.

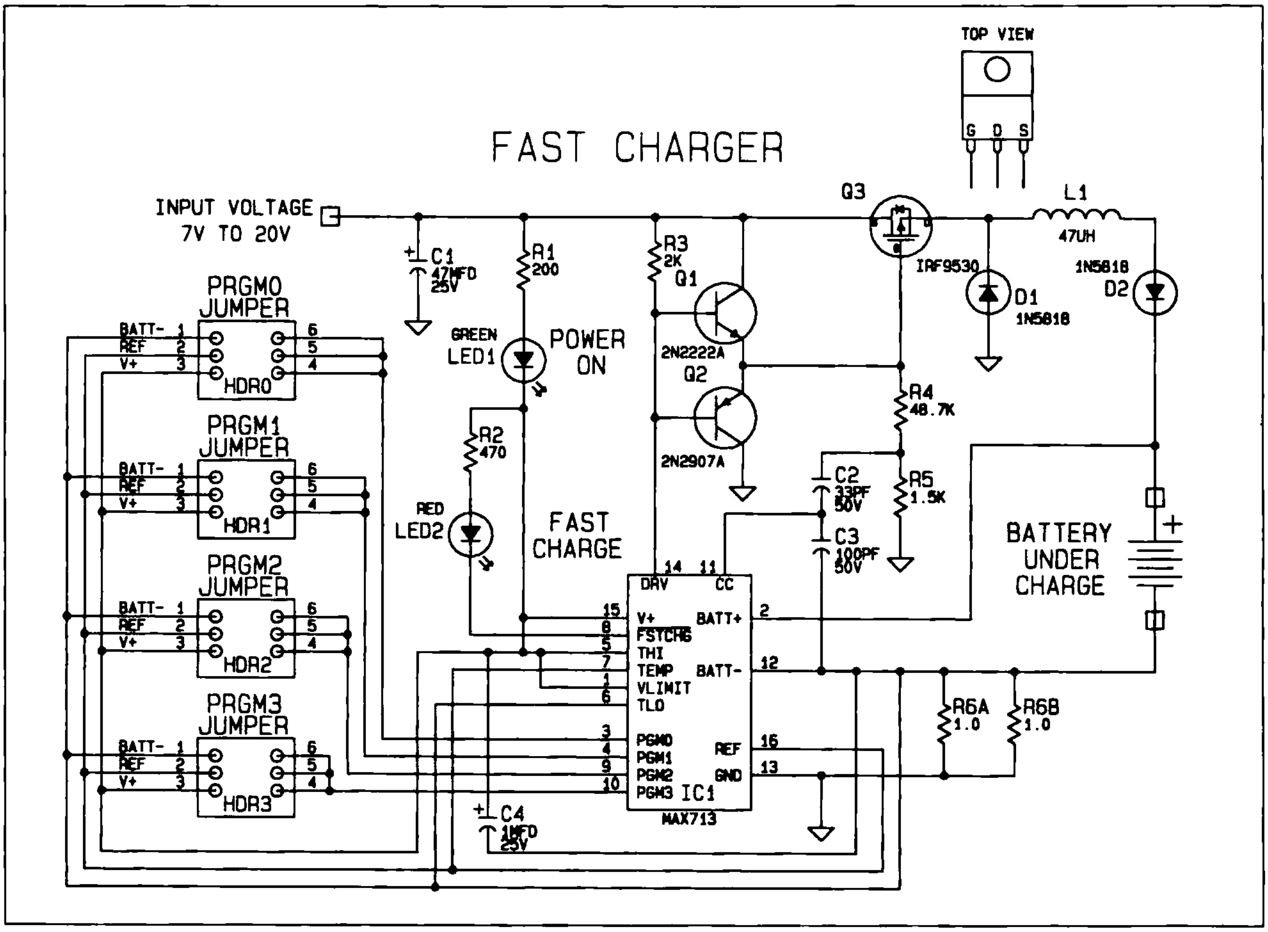


Figure 1. Schematic for the Fast Charger.

These chargers are simply unregulated constant current supplies. On the other hand, Fast Charger is controlled by the Maxium Products MAX712 or MAX713 integrated circuits, allowing a fast high current charge without damage to the batteries. The MAX712 part is used to recharge NiMH batteries. The MAX713 is used to recharge NiCd batteries. The only difference between the parts is the way the part detects the end of a fast charge cycle. The MAX712 detects the end of a fast charge cycle when the battery voltage plateaus; the MAX713 detects the end of a fast charge cycle when the battery voltage starts to decline. When the MAX712/3 senses these output voltage behaviors, it automatically switches to trickle charge. Trickle charge is also reached when the MAX712/3 determines that a maximum expected recharge time interval has elapsed.

Circuitry and Pin Programming

My prototype layout uses a hand-drawn PC board. The only critical signals are the capacitors connected to pin 11 of the MAX712/3 device. These connections should be as short as possible. The other critical path is the inductor, diodes and transistor, which constitutes a switching power supply. The traces to these devices should be as short as possible to reduce the stray inductance/resistance, which will degrade the efficiency of the switching power supply.

The MAX chip contains circuitry that does most of the work. A voltage regulator regulates the output voltage to recharge the batteries, a current-sensing amplifier senses the current through the battery and adjusts the output drive of the pass transistor to control the current into the battery. A temperature sensor option is not utilized in this design. An analog-to-digital circuit samples the battery voltage and determines the output voltage of the battery over time. A timer circuit monitors the charge times and issues a time-out if the expected recharge time has been reached. Finally, control logic monitors the four program pins of the device and controls timing internal to the device.

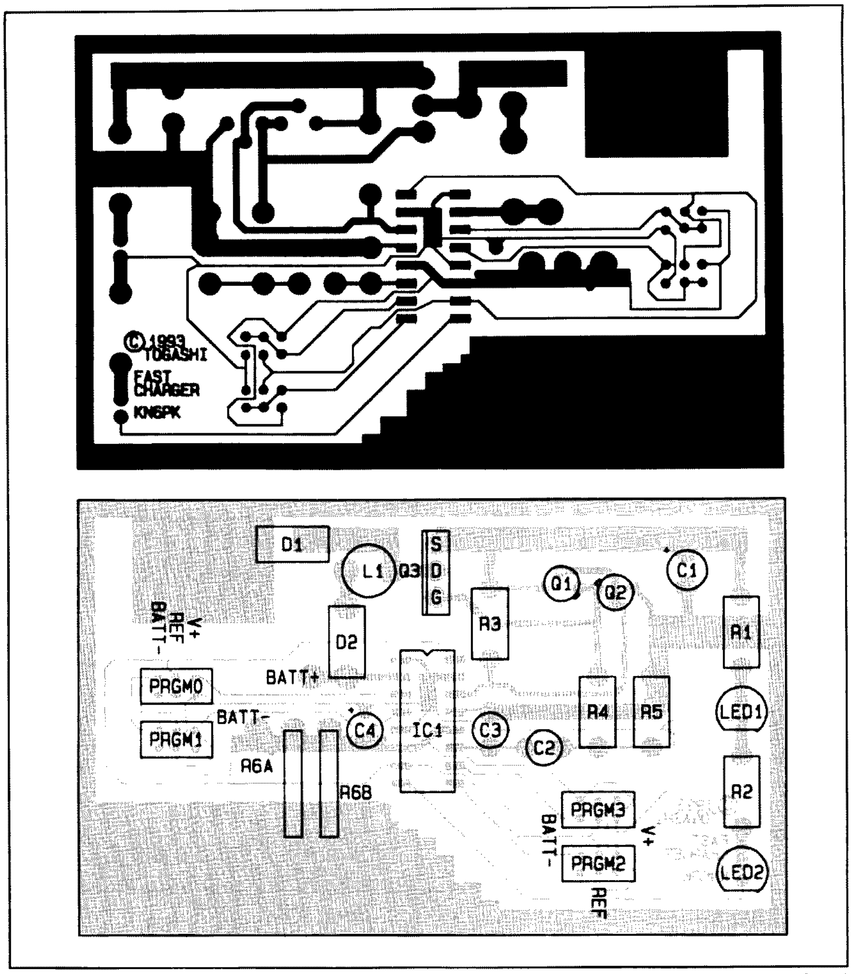


Figure 2. A drilled and etched PC board for the Fast Charger is available for $5 plus $1.50 S & H per order from Far Circuits, 18N640 Field Court, Dundee, IL 60118.

The four program pins of the device set the battery cell count and the expected recharge time. Program pins PRGM0 and PRGM1 set the cell count, the number of cells which the recharger is set to recharge. The cell count is made by either counting the cells or dividing the expected output voltage by 1.2 volts. In my application with four cells, PRGM1 and PRGM0 are shorted to BATT- and V+ respectively. PRGM2 and PRGM3 program pins set the time-out period for the expected recharge time. To determine the expected recharge time, first pick the recharge rate for the circuit. In my de-

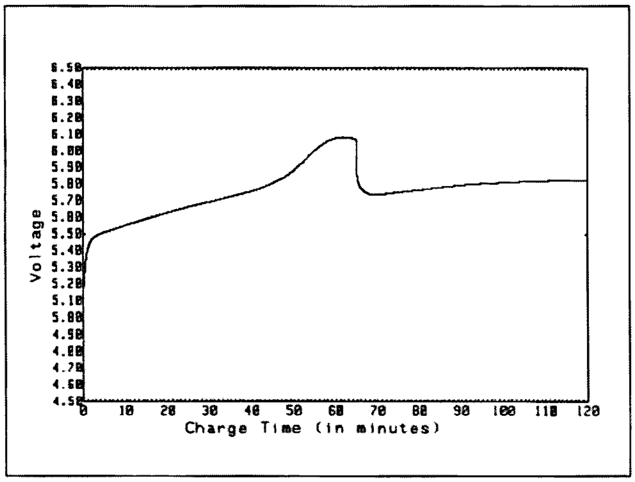


Figure 3. Operating characteristics when recharging a typical NiCd battery.

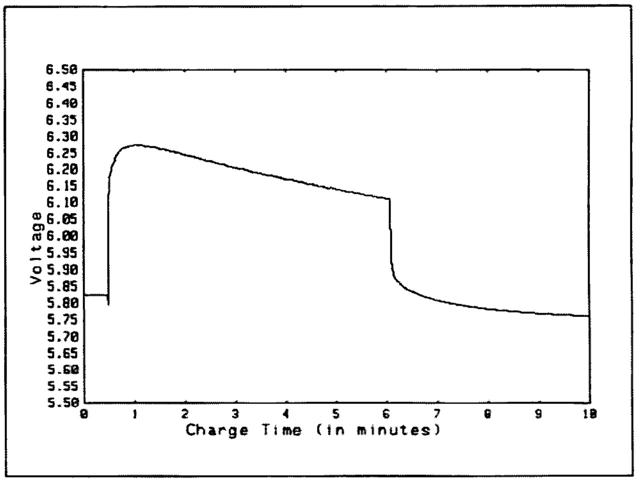


Figure 4. The same battery pack subjected to Fast Charge after the pack has been fully charged. Note the quick switch to trickle charge.

sign, the batteries I want to recharge are AA 500 mA per hour cells. I set Fast Charger to recharge the cells at 1 times the capacity, or 1C. Rechargeable batteries are not 100% efficient when recharged, so the expected recharge time is approximately 20% higher than the expected time, hence for 1C recharge rate, the expected recharge time is about one hour and 15 minutes. The closest time interval available for a one hour and 15 minute time-out is 90 minutes, which is enabled by shorting PRGM2 and PRGM3 to the REF voltage pin.

Table 1 defines the program pin programming to select the desired settings for the number of cells and for the time period. The Charge Rate in C is the charge rate as set by R6. I use jumper blocks with shorting blocks (like the ones used in PCs to set up the expansion cards) to set the programming options. DIP switches or jumpers can also be used. PRGM3 also sets the trickle charge current value. When PRGM3 is open, the trickle charge current is the fast charge rate divided by 32. When PRGM3 is connected to REF, the trickle charge current is the fast charge rate divided by 16. When PRGM3 is connected to BATT-, the trickle charge current is the fast charge rate divided by 8. My application uses the PRGM3 pin tied to REF, so my trickle charge rate is 500 mA divided by 16, or 31 mA.

Q1-Q3, L1, D1 and D2 form a DC-DC switching power supply which supplies a current source to the batteries with overvoltage protection. D1 and D2 are Schottky Barrier Rectifiers which have low-forward voltage drops and are fast devices (low internal capacitance) to keep the DC-DC converter at peak efficiency. Q1 and Q2 boost the drive to Q3, turning Q3 on hard and off hard. Q3 was chosen for the low drain to source resistance of 0.3 ohms. With such a low drain to source resistance, no heat sink is required for Q3, i.e. Power Dissipation = (drain current)^2 x (drain to source resistance) which is below 100 milliwatts. L1 is charged by Q3. When Q3 turns on, current is stored in L1 and discharges through D2 into the battery. When Q3 turns off, current will continue to flow through L1 from the current stored in L1 and through D1. L1 must be both electrically large to accommodate the large current flow and physically large to prevent saturation (saturation is when L1's core cannot hold any more magnetic flux, causing L1 to look like a resistor with a resistance value of the inductor wire). For topology buffs, the topology used here is the Positive Buck Converter.

LED1 and LED2 are used for charging indicators. When power is applied to Fast Charger, LED1 illuminates. When fast charging is active, both LED1 and LED2 illuminate. When fast charging is complete, LED2 extinguishes and LED1 remains on.

Power to the Fast Charger requires a 1 volt input voltage over the highest battery voltage, with a minimum voltage of 7 volts and a maximum voltage of 20 volts. The maximum battery voltage is: (1.65 volts) x (the number of cells). The minimum current required is equal to the fast charge current. I built my Fast Charger to run off a car battery to recharge RC Slope Glider batteries. If home use is expected, then a wall-mount transformer with the appropriate DC output voltage and current is all that is needed.

Operating the Fast Charger is simple. Plug or switch the desired program input pins to match the cell count and the charging time requirement. Apply power to the Fast Charger circuit and install the batteries. Fast charging will begin, and the batteries are charged to the peak capacity when the fast charging cycle is completed. The batteries may be left attached to the Fast Charger for the batteries to receive a trickle charge. At the end of the fast charge, the batteries may feel warm, but they should not feel excessively hot (greater than 120 degrees Fahrenheit). If the batteries become hot, then the fast charge current is too excessive. Increasing the value of R6 will alleviate the problem.

I ran into the following problems: If Fast Charger draws excessive current, check Q1 and Q2, they may be swapped causing the excessive current draw; if Fast Charger will not go into trickle charge, verify C2 and C3 values.

PRGM 1 and PRGM 2 Pin Connections to Define Cell Count

No. of Cells	PRGM1 Connection	PRGM0 Connection
1	V+	V+
2	open	V+
3	REF	V+
4	BATT-	V+
5	V+	open
6	open	open
7	REF	open
8	BATT-	open
9	V+	REF
10	open	REF
11	REF	REF
12	BATT-	REF
13	V+	BATT-
14	open	BATT-
15	REF	BATT-
16	BATT-	BATT-

PRGM 2 and PRGM 3 Connections to Define Time-out to Trickle Charge and Associated Charge Rate

Time-out (minutes)	Charge Rate in C	PRGM3 Connection	PRGM2 Connection
22	not used	V+	REF
33	not used	V+	BATT-
45	2.0C to 1.5C	open	REF
66	1.4C to 1.1C	open	BATT-
90	1.0C to 0.8C	REF	REF
132	0.7C to 0.5C	REF	BATT-
180	0.4C	BATT-	REF
264	0.25C	BATT-	BATT-

Table 1. To control the charge rate, the current sensing resistor must be chosen. First pick the rate to recharge the batteries (between 0.25C and 2C). The current sensing resistance value is: R6 = (0.25 volts) / [(fast charge rate) x (battery capacity)]. I require a rate of 1C for my 500 mA/hour batteries, so the resistor value is calculated as follows: R6 = (0.25 volts) / [(1C) x (0.5 A/hours)] = 0.5 ohms.

Parts List

Part	Description	Digi-Key #	Price ($)
C1	Capacitor, 47 uF 25V	P5696	0.24
C2	Capacitor, 33 pF	P4018	0.06
C3	Capacitor, 100 pF	P4024	0.06
C4	Capacitor, 1 uF 25V	P6742	0.53
D1,D2	Diode, 1N5818	1N5818	0.56
IC1	IC, MAX713 or MAX712	MAX713CPE	
		MAX712CPE	6.27
L1	Inductor, 47 uH, 1 amp	TK4355	2.68
LED1	Green LED	P303	0.18
LED2	Red LED	P300	0.25
Q1	Transistor, 2N2222A	PN2222A	0.19
Q2	Transistor, 2N2907A	PN2907A	0.19
Q3	Transistor, P enhancement FET, Rds = 0.3 ohms	IRF9530	2.40
R1	Resistor, 200 1/4W	200Q	0.05
R2	Resistor 470 1/4W	470Q	0.05
R3	Resistor, 2k 1/4W	2KQ	0.05
R4	Resistor, 48.7k 1/4W 1%	48.7KX	0.11
R5	Resistor, 1.5k 1/4W	1.5KQ	0.05
R6	Resistor, as required for IC	1.0Q	0.05
HDR0-HDR3	Header, 6-pin	S2012-06-ND	1.11
JMPR0-JMPR3	Jumper for headers	S9000-ND	1.09
Socket	Socket for IC1	ED3316	0.83

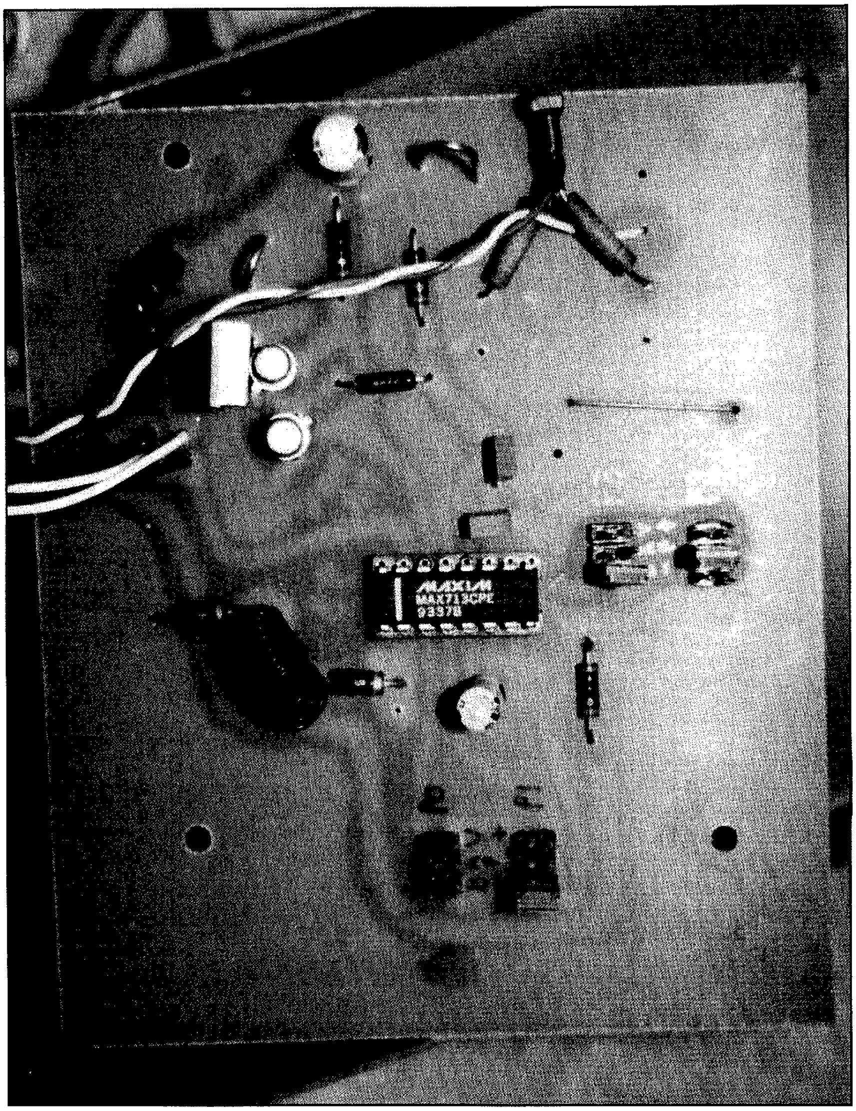


Photo A. A drilled and etched PC board for the Fast Charger is available from for $5 plus $1.50 S & H per order from Far Circuits, 18N640 Field Ct., Dundee, IL 60118..

All the parts used on this project are available from Digi-Key Corporation, (800) 344-4539.

Schematic

The schematic in Figure 1 shows the circuitry. The left side of the schematic shows the programming devices. Shorting jumpers, headers with jumper shorting blocks or switches can substituted for these devices. R6 is shown as two resistors. This allows custom values of non-standard resistance by using readily available standard resistance values and placing them in parallel.

Figure 3 shows the operating characteristics when recharging a battery. A four-cell 500 mA hour NiCd pack was subjected to the Fast Charger. The chart shows the battery output voltage verses time. The start of the plot is power applied to the Fast Charger. Battery voltage increases with charging and then peaks at about 60 minutes into the charge. The battery voltage peaks and then begins to fall. Fast Charger detects the drop in battery voltage and shuts off the fast charge current and enters trickle charge at approximately 65 minutes into the charge.

Figure 4 shows the same battery pack subjected to Fast Charger after the pack has been fully charged. Again the chart shows battery voltage versus time. Since the pack is fully charged, the battery voltage peaks quickly and then the output voltage begins to drop. After approximately five minutes and 30 seconds into the charge, Fast Charge detects the drop in battery output voltage and changes from fast charging to trickle charging.

I hope that Fast Charger recharges your batteries as easily, quickly and automatically as it does mine. Fast Charger allows convenient quick charging of virtually any battery pack on the market.

I would like to thank Jim Keller KD6JWO for setting up and programming the HP Chart Recorder used for Figures 3 and 4, and for building the first "production" unit.

The Radar Gun Reality

Ham scientist testifies on electromagnetic radiation.

Introduction by Wayne Green W2NSD/1

[You've probably been reading the same media twiddle about the dangers of cellular telephones and radar guns I have. And by extension, a danger from our HTs. You've been reading that there are conflicting data on these dangers. You've been reading tripe.

We are most fortunate to have Ross Adey K6UI . . . one of ours . . . as the world expert in this controversial field. Ross has been researching the effects of electromagnetic waves from DC up through the microwaves. He's been doing this for years. On the off chance that you may be interested in reading one of his reports, I'm going to reprint his testimony to the Ad Hoc Subcommittee on Consumer and Environmental Affairs of the United States Senate Committee on Governmental Affairs, Senator Joseph Lieberman, Chairman. His testimony was given for a "Hearing on health risks posed by radar guns; the extent of federal research and regulatory development of microwave emissions from hand-held radar guns."

Got all that?

The testimony was given August 7, 1992, by W. Ross Adey, M.D., of the Pettis Memorial VA Medical Center, Loma Linda, California.

Now, if you have some difficulty in reading this technical testimony, just imagine how little our average senator got from it . . . if it was even read, which is unlikely. Few of our senators have any technical background, so all this is gibberish to most of them.

If you ever get in touch with your senator you might ask him about the danger of radar guns and see what he says. It's good for a laugh anyway . . . Wayne]

1. Introduction

Mr. Chairman, thank you for this opportunity to appear before the Committee. I am William Ross Adey, and my testimony is presented as a private citizen. Since 1977, I have served as Associate Chief of Staff for Research and Development at the Pettis Memorial VA Medical Center at Loma Linda, California. I am a Distinguished Professor of Medicine (Neurology) at the affiliated Loma Linda University School of Medicine. My activities relevant to this hearing include founding membership in the Biomedical Commission of the International Union of Radio Sciences, with authority in the USA vested in the National Academy of Sciences; and as a consultant to the World Health Organization in health problems of nonionizing electromagnetic radiation. I am an elected Fellow of the Institute of Electrical and Electronics Engineers. From 1957-1977, I was a faculty member at the UCLA School of Medicine and Director of the Space Biology Laboratory of the UCLA Brain Research Institute.

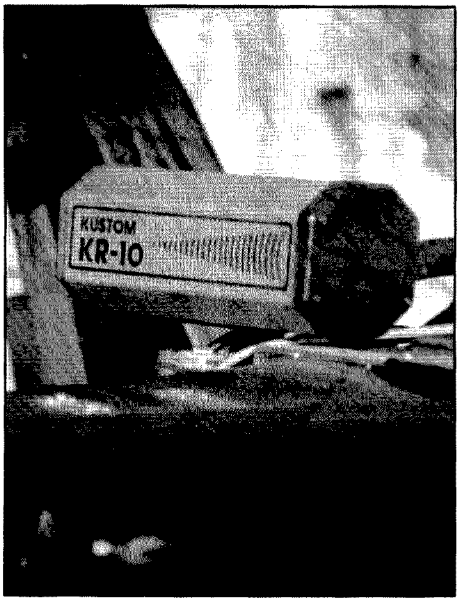
For the past 46 years, my research career has covered a broad spectrum in neurology and the brain sciences, in environmental medicine, in biomedical and communication engineering, and in cell biology of molecular and atomic processes by which cells of brain and body tissues communicate with one another.

These latter processes have been the exclusive focus of our team's research for almost 20 years. We have played a pioneering role in understanding how body cells "whisper" to one another; and in so doing, we have discovered some of the keys to understanding how electromagnetic fields, so weak that some scientists have regarded them as incapable of biological effects, are detected by living tissues. We have studied some of the likely consequences for human health.

The problem of exposure of a restricted segment of the population to radar guns is but an example of the enormous and ever-growing use of systems and devices in our society that emit a vastly complex range of electromagnetic fields. The ubiquitous use of electricity makes it a factor of great and serious import in shaping the future of our society. For the individual, these same concerns are likely to touch all our lives in very personal ways.

2. Natural and man-made fields in our electromagnetic environment.

In any discussion of biological and biomedical effects of electromagnetic fields, it is necessary to understand that these fields are *oscil-*



Police radar guns are not always hand-held. Instead, many are mounted onto the dashboard, still in close proximity to the officer. Photos by Charles Warrington WA1RZW; courtesy of Greenfield, NH, Police Department.

lating, meaning that they are waves that move through the universe, surging with a succession of peaks and troughs past an observer. These natural waves cover a vast *spectrum*, or range of frequencies. Just as in the piano where there is a range of frequencies covering many octaves from the low notes to the high, so also this electromagnetic spectrum covers many octaves. They range from very short waves with high frequencies to long waves at low frequencies; but they all travel at the same speed, 186,000 miles (or 300,000 kilometers) per second.

Amongst the very long waves are those oscillating at the power line *frequency* of 60 cycles per second, or 60 Hz. Their peaks are 5 million meters, or about 3,000 miles apart. As these waves become shorter, we enter the radio spectrum, where an AM broadcast station emitting waves at 1 million cycles/sec (1000 kilohertz [kHz] or 1.0 megahertz [MHz]) sends waves with a length of 300 meters. The microwave region of the spectrum begins by definition at a frequency of 300 million waves per second (300 MHz, waves 1 meter long) and extends by definition to 300 billion waves per second, or 300 gigahertz (GHz). At 300 GHz, the waves are only one twenty-fifth of an inch, or 1.0 millimeter long. Police radar guns operating at 10 GHz (X-band) and 24 GHZ (K-band) have wavelengths of 30 millimeters and 13 millimeters respectively (1.2 and 0.5 inches).

But this is by no means the limit of the electromagnetic spectrum. It extends many octaves beyond the millimeter wave band, with ever shortening wavelengths and ever higher frequencies of oscillation. Millimeter waves are succeeded by the infrared spectrum, and this in turn by the spectrum of visible light, covering barely an octave as wavelengths shorten from red to blue. From the visible region of the spectrum, there is a progression through the ultraviolet, to X-rays and ultimately to the very short cosmic rays from outer space.

In a biological perspective, all life on earth has evolved in a sea of low-frequency electromagnetic fields, generated in part from the sun and also from the huge energy of thunderstorm belts in the Amazon basin and in central Africa. In an historical perspective, this natural electromagnetic environment has been vastly perturbed since the beginning of the 20th century by an ever-increasing level of artificial electromagnetic fields.

These artificial fields now bathe us throughout our lives, in our homes, in the workplace, and in the environment. In two important ways, they differ from the natural electromagnetic environment. Firstly, they are typically hundreds and in some cases millions of times stronger than the natural fields. Secondly, and most importantly in this hearing on possible health effects of weak microwave exposure, most energy of the natural fields occurs at frequencies below 100 cycles per second (100 Hz). That is, they surge back and forth less than 100 times per second as *oscillating* fields. Natural sources, such as the sun, produce only small amounts of high-frequency energy in the radio and microwave regions of the electromagnetic spectrum.

In contrast, man-made devices and systems now expose us all to an electromagnetic environment of almost unbelievable complexity from conception to death. In addition to low-frequency fields associated with electric power distribution systems and the devices and systems operating directly from the power system, most urban and suburban environments also involve exposures to radio frequency and microwave fields. Obviously, the magnitude of these exposures depends on proximity to the sources; whether, for example, near industrial radio frequency heating systems for plastic molding and sealing plastic surfaces; or to radio, TV and microwave transmitters widely scattered in most urban and suburban environments; or in the use of hand-held portable transceivers placed close to the head of the user; or in microwave radar sources close to body parts, as with police radar guns placed in the groin in an operating condition.

3. The scope of federal research on microwave emissions.

With such a vast range of frequencies in the electromagnetic spectrum, it is inevitable that

to date only scattered segments have been explored for their biological interactions. Biological and biomedical research has been restricted by limitations on funding. This has come mainly from Federal agencies seeking early answers to specific problems in mission oriented research. National fashions in research have emerged in consequence. Thus, public and congressional preoccupation over the past decade with possible hazards of 60 Hz electric power sources has made it essentially the sole facet of nonionizing electromagnetic field research supported by federal civilian agencies.

Until recently, when the National Institute of Environmental Health Sciences manifested a renewed interest, the US Department of Energy has been the sole custodian of a Federal civilian research program in nonionizing radiation since 1986. At that time, the US Environmental Protection Agency eliminated its active and highly regarded program.

Even with a strong focus on 60 Hz bioeffects, to the exclusion of other urgent problems, a total DOE budget of less than $5 million has been seriously inadequate in the search for needed knowledge of the mechanisms underlying weak EM field interactions with living tissues. For more than ten years, there has been virtually no federal civilian funding or medical research on effects of radio frequency or microwave fields.

Within the Department of Defense, the US Air Force has assumed the role of Lead Agency in microwave research. US Air Force studies deal exclusively with effects of high level exposures, with effects attributable to tissue heating. As a matter of policy, the Air Force denies existence of biological effects attributable to *athermal* fields (Erwin, 1988). Nevertheless, evidence for athermal bioeffects is incontrovertible for both low-frequency and radio frequency exposures, and tissue heating is not the basis of these interactions. All exposures of law enforcement personnel to radar guns are athermal, so that if there are biological consequences, models and mechanisms to explain these interactions cannot be based on heating models that are the essence of ANSI/IEEE guidelines. I shall return to these issues in greater detail, including the regulatory aspects.

3a. *Research on biological and biomedical effects of microwave fields.*

My principal purpose is to review the scope and content of research relevant to possible health hazards of microwave emissions from traffic radar guns.

It is important to first address the question of what our expectations might be from research on devices or systems viewed as potential environmental health hazards. It is the premise of protagonists of police radar guns that there is no significant risk from these microwave exposures. To the contrary, their documentation may be generously interpreted as only showing that, at best, there is no proven hazard.

Although limited in scope by totally inadequate funding from either federal or other sources over the past decade, research in the USA and elsewhere on bioeffects of athermal RF/microwave exposures has contributed strong indicators that the possibly hazardous nature of these exposures must be seriously considered.

Two major streams of new knowledge have emerged. On the one hand, *epidemiology* studies have addressed human diseases that now appear ever more closely related to environmental electromagnetic field exposure. On the other, laboratory studies in cells, tissues and animal models have disclosed in considerable detail many of the *fundamental mechanisms* by which extremely weak electromagnetic fields interact with cells and tissues.

As I pointed out at a related hearing by the Subcommittee on Natural Resources of the House Committee on Science, Space and Technology (7/25/90), it is important to emphasize that these studies at the cell and molecular level have built, and continue to build, a series of critically important bridges between laboratory science and human epidemiology; so that it is no longer possible to say that mechanisms mediating interactions of electromagnetic fields with biomolecular systems remain unknown with respect to potential health problems.

In many respects, studies of mechanisms provide essential signposts and directives that will determine the very nature of further epidemiology studies. For example, laboratory studies have revealed enhanced effects of chemical cancer promoters in joint actions with electromagnetic fields; thus, the epidemiological hunt for the basis of increased cancer risk now invites detailed consideration of possible joint effects of environmental chemical pollutants and electromagnetic fields. For operators of police radar guns, for example, there is the question of long-term concurrent exposure to automobile exhaust fumes as a possible adjuvant factor.

4. Health-related effects of athermal RF/microwave fields; laboratory studies in cells and tissues.

ANSI/IEEE guidelines consider tissue heating as the sole premise on which to base safety standards, precluding from any consideration the very existence of athermal interactions. It is therefore imperative to identify by specific citations some of the findings in much weaker athermal exposures that may bear, directly or by extrapolation, on potential human health hazards.

The following account describes RF/microwave field effects at athermal exposure levels, substantially below limits permitted under ANSI/IEEE guidelines. Virtually all have received some form of federal support.

Most laboratory tests with RF/microwave fields at frequencies below 1000 megahertz (1.0 gigahertz) have reported effects of *low-frequency modulation*, or periodic interruption, of the high-frequency carrier wave. If a long-range radar transmitter is used (not a police radar gun), the signal is typically "pulsed" at frequencies from 5 to 1000 pulses per second; or the signal may be rhythmically modulated with a sine-wave signal, typically at frequencies below 100 Hz. At carrier wave frequencies below 1000 MHz, bioeffects have been reported with *unmodulated* carrier waves only with fields sufficiently intense to cause tissue heating.

4a. *Summary of major effects of modulated RF/microwave fields.*

A gamut of effects has been reported, most confirmed in independent studies in different laboratories. They relate to a hierarchy in the ordering of biological systems.

i) *Modification of calcium binding* at cell surfaces has been a pivotal observation, confirmed in many studies (Bawin et al., 1975; Blackman et al., 1979, 1985; Dutta et al., 1984; Lin-Liu and Adey, 1982). Calcium is the key messenger, carrying messages (from hormones, antibodies, neurotransmitters and chemical cancer promoters) from cell surfaces to the interior. Calcium also mediates signals between cells that prevent unregulated cell growth and tumor formation.

ii) *Actions on cells of the immune system.* The body's immune system is the fortress built by nature against infection and the creeping claws of cancer. Reduced immune competence is therefore followed by dire consequences for the individual, whether it results from aging, from the ravages of infections such as AIDS, or from environmental chemical pollution. *Lymphocytes* of the immune system can be "targeted" against tumor cells, destroying them by breaking their covering membranes.

A malignant tumor of the lymph glands of the groin (*malignant lymphoma*) has been reported in users of police radar guns. In studies with cell cultures, athermal microwave fields (450 MHz, 1.5 mW/cm^2) with 60 Hz modulation reduced by about 20 percent the killing capacity (*cytotoxicity*) of lymphocytes targeted against human lymphoma cells (Lyle et al., 1983). Unmodulated 450 MHz fields had no effect. These fields also disrupted by up to 60 percent activity of enzymes that act as internal messengers inside lymphocytes, including messages regulating cell growth (Byus et al., 1984).

iii) *Modification of enzyme activity regulating cell growth.* A series of studies in different laboratories have reported sensitivities to modulated RF/microwave fields of growth-regulating enzymes located within widely differing types of mammalian cells (Byus et al., 1984, 1988; Krause et al. 1990). In confirmation of the athermal character of these interac-

tions, they have been shown to depend on the presence of low-frequency modulation, rather than simply on field intensity; and more specifically, to relate to a narrow band of modulation frequencies in a fashion described as a *frequency window*. These phenomena are quite inconsistent with thermal models.

iv) DNA synthesis in cultured mammalian cells following exposure to increasing microwave fields at constant temperature. Cultured human blood lymphocytes and human brain cells can be exposed to increasing levels of 2.45 MHz CW microwaves, but maintained at their normal 37 degree Centigrade environment. Under these conditions, they synthesize DNA with a sharp peak in the response in a narrow range of field intensities (Cleary et al., 1989). This is an *intensity window*, also quite inconsistent with thermal models of interaction.

4b. *The millimeter wave region: bioeffects of fields similar to those in police radar guns.*

Police radar guns operate with a continuous wave (CW) signal at either X-band (10 GHz) or K-band (24 GHz). Their frequencies are high enough to resonate directly with the vibrations of biological molecules or portions of these molecules. These direct molecular interactions do not occur at lower frequencies.

Biomolecular and cell research in this spectral region has been meager. Studies in solutions of DNA and of growth effects in bacteria have yielded conflicting results that may relate to extreme technical difficulties not encountered at lower frequencies. There are major problems in the engineering of suitable exposure systems, in ensuring biocompatible exposure devices, and in evaluation of experimental data for physical and biological artifacts.

4b.1. *Cell growth responses to millimeter wave exposures.* These studies may have special significance. They have opened new doors to understanding mechanisms that underlie bioeffects of extremely weak millimeter wave fields. The definitive findings are the product of a single team of highly competent German scientists, collaborating for the past 15 years within the framework of the prestigious national Max Planck organization (Grundler et al., 1977; Grundler and Keilmann, 1978).

Their work has examined effects of millimeter wave fields on growth of yeast cells, a cell type commonly used in biological and biomedical research concerned with cell growth and genetic mechanisms. We are concerned here with *process*, with mechanisms at a level so fundamental in living systems that they are found in most, if not all, cellular organisms. By extrapolation, these studies raise questions about the possibility of comparable effects in human tissues exposed to fields of the type produced by police radar guns. At the same time, it must be emphasized that only with much further research can we determine the validity of this interpretation.

In the first studies by the German team, yeast cell cultures were irradiated with continuous wave millimeter fields at field intensities of a few milliwatts/cm^2. The growth rate was considerably enhanced or reduced depending on the field frequency around 42 GHz, with a succession of peaks and troughs at intervals of about 10 MHz. In agreement with our earlier analogy with a piano, the cells' growth response appeared finely *tuned* to the frequency of the applied field. Careful temperature monitoring excluded a trivial thermal origin for this effect. Repetition of this experiment confirmed that yeast culture growth is indeed affected by weak microwave radiation in a frequency-selective manner (Grundler et al., 1983; Grundler and Keilmann, 1983).

These early experiments have been substantially improved and extended (Grundler, 1990). Growth of single yeast cells has been measured microscopically, and orientation of each cell controlled with respect to the imposed field (Grundler and Kaiser, 1992).

A notable finding in these recent studies is that the sharpness of the tuning increased as the intensity of the imposed fields decreased; but the tuning peak occurred at exactly the same frequency as the field intensity was progressively reduced. Moreover, clear responses occurred at incident field levels of 5 picowatts/cm^2, about one million times below field levels permitted under ANSI/IEEE

guidelines for millimeter wave exposure.

What do these studies suggest about a threshold, or lower limit for sensitivities to these weak fields? Theoretical and experimental modeling has gone hand in hand with biological studies. New conclusions are striking, even challenging, with respect to potential health hazards. Professor Friedemann Kaiser, a theoretical physicist with the Max Planck organization and a world authority on weak millimeter wave interactions (Kaiser, 1983, 1988), concludes that, in interactions between an imposed field and an oscillator within a cell, "... imposed fields can be active even at intensities near zero" (Grundler and Kaiser, 1992). In other words, a lower limit or threshold would not exist.

Research at the other extreme in the electromagnetic spectrum with 50 and 60 Hz electric power fields also support this concept. Theoretical and experimental studies at the University of Oxford by McLauchlan (1992) conclude that sensitivities in biomolecular systems may exist even at the lowest levels of magnetic energy input. Based on interactions between magnetic fields and chemical forms known as "free radicals" there can be "an enormous effect of a small magnetic field on a chemical reaction, and the effect begins at the lowest applied field strength."

5. Physical and engineering aspects of operator exposure to radar gun exposures.

If extremely weak millimeter wave fields can interfere with mechanisms regulating cell growth, are radar gun operators exposed in ways that might pose risks?

5a. *What field intensities exist at the aperture of radar guns?*

Many thousands of measurements have been made by Fisher (1991) in the period 1982-1991. For X-band (10 GHz) models popular in the early 1980s, the average antenna aperture power density was 3.36 mW/cm^2 for fixed-mount devices, and 2.66 mW/cm^2 for hand-held devices. With later development of K-band (24 GHz) technology, the average aperture power density dropped to 0.93 mW/cm^2 for fixed-mounted systems and 0.69 mW/cm^2 for hand-helds.

These incident field levels are approximately one million times higher than incident fields changing growth of cells by direct exposure.

5b. *Are there circumstances in which all or most of this energy would reach the surface of the body?*

Fisher's (1991) extensive evaluation of microwave exposures encountered by traffic radar operators states that with hand-held devices, "when it is placed in the operator's lap, 100% of the aperture power density would be incident upon portions of the radar operator's body that are in contact with the antenna's aperture. Radar operators who place the hand-held device in their laps or inadvertently point the antenna towards themselves will find themselves in the HPD (High Power-Density) region of the antenna, with exposure to more than 1.0% of the aperture power density."

5c. *Will most of this energy enter the body or will it be reflected from the skin?*

As discussed in the next Section, relatively little reflection of millimeter waves occurs at the body surface. Most field energy penetrates the body surface and is absorbed by body tissues.

5d. *If the field enters the body, how deeply will it penetrate before dropping to levels less than those shown to alter cell growth?*

Millimeter waves are rapidly attenuated as they penetrate the body surface. This rapid weakening of the field is due to energy absorption by water molecules. In engineering terms, this attenuation is measured at 17-20 decibels/millimeter. In more familiar terms, as little as 1.0 percent of the field energy at the body surface will be found 1.0 millimeter below the surface; and at a depth of 3 millimeters (one-eighth of an inch), the field intensity will be one-millionth of that at the surface.

How do these physical properties of the body determine the actual tissue field levels from operating radar guns in close contact with the body surface? It appears a reasonable conclusion that for antenna aperture densities of 1-3 $milliwatts/cm^2$, fields at picowatt levels will be found at depths of 3 millimeters; and as noted above, there is evidence that millimeter wave fields at this intensity can modify cell growth.

5e. *Are organs such as the testis or lymph glands in the groin close enough to the body surface to be exposed to significant field levels?*

I now wear the hat of an anatomist with more than 30 years' experience in teaching and research in the anatomy of the human body in the Australian medical schools of the Universities of Adelaide and Melbourne, in the University of Oxford, and at the University of California at Los Angeles.

As *Gray's Anatomy* points out, "The skin of the testis is extremely thin." It is devoid of fat, so that the scrotal contents may be transilluminated with a flashlight. In consequence, the testis itself has a very narrow separation from the skin surface, typically not exceeding 2 millimeters. Thus, picowatt level fields may be anticipated in the outer zones of the testis from incident fields on the skin surface in the low milliwatt range.

A similar situation pertains for the lymph glands of the superficial inguinal group in the fold of the groin. Malignant lymphoma has been reported in lymph glands in this region in association with exposure to police radar guns. By reason of the arrangement of major ligaments and fascial sheets in this region, these lymph glands lie close to the overlying skin, with minimal amounts of fat separating them.

6. Epidemiology of human microwave exposure.

For the millimeter wave spectrum, there have been no epidemiological studies. For other parts of the microwave spectrum, some findings in limited studies may be relevant by extrapolation to millimeter wave exposures.

Szmigielski et al. (1988) examined cancer incidence amongst Polish career military personnel. The major exposure was to radar microwave fields, but exposures to 50 Hz power fields were also involved. Differences in cancer rates between exposed and unexposed subjects were large, with rates generally six times higher in exposed than in unexposed subjects. Most malignancies were reported as lymphomas and leukemias.

Yugoslav microwave workers have shown abnormalities in blood lymphocyte chromosomes (Garaj-Vrhovac et al., 1990) in studies that compared these findings with similar, more severe changes in vinyl chloride workers. Exposures were of long duration (8 to 25 years, mean 15 years). Microwave power densities at the work sites were in the range 10 to 50 $microwatts/cm^2$, or approximately 1 percent of levels permitted under ANSI/IEEE guidelines. These same researchers produced similar chromosome abnormalities in mammalian cell cultures exposed briefly (15, 30 and 60 min) to a 7.7 GHz field at an intensity of only 0.5 mW/cm^2, or one-twentieth of levels permitted in the revised ANSI/IEEE guideline.

The long exposures experienced by these Yugoslav workers raises questions about possible effects of *cumulative* dose, a factor also raised in case reports of police radar gun operators. This problem was addressed directly in studies of brain tumor incidence in RF/microwave workers by the National Cancer Institute (Thomas et al., 1987). Microwave workers were grouped by length of exposure in 5-year cohorts. No measurements of field exposures were available. Incidence of malignant brain tumors (astrocytomas) was progressive with length of exposure. For those in excess of 20 years, the risk was 10 times control levels, if they were simultaneously exposed to microwaves and soldering fumes, electronic solvents and a variety of other chemicals. All the excess risk was for those engaged in design, manufacture, repair and installation of electrical or electronic equipment, suggesting joint actions of chemical factors and RF/microwave fields, as already discussed.

7. Regulatory considerations: the ANSI/IEEE guidelines.

The results of much research presented here leave little doubt about the reality of athermal bioeffects of RF/microwave fields and their importance with respect to potential human health hazards. Nonetheless, this knowledge has yet to take its place in any safety guidelines. Those private bodies presuming to advise government, industry and the general public have produced guidelines based solely on tissue heating thresholds.

In the absence of federal regulations relating to any environmental electromagnetic field exposure, limits promulgated as "guidelines" by the American National Standards Institute (ANSI) became the *de facto* standards for occupational and non-occupational exposure in 1982 (ANSI Standard C95.1-1982, covering the spectrum from 300 kHz to 100 GHz). Subsequent revisions of the ANSI C95.1-1982 Standard, now known as IEEE

C95.1-1991, were undertaken in behalf of ANSI by Subcommittee 28 of the IEEE Standards Coordinating Committee (SCC28).

By uncompromising adherence to thermalizing levels of exposure (10 mW/cm^2) at frequencies above 1.5 GHz as the sole basis for human health concerns, the new ANSI/IEEE guidelines raise questions of objectivity in reviewing available evidence. There has been a willful refusal to consider the significant volume of highly credible scientific evidence on athermal effects, dismissed by the co-chair of Subcommittee SCC28, Dr. Eleanor Adair (1990), as "today's grab bag of contradictory or unreplicated evidence and miscellaneous theory, falling far short of credibility."

Worse, the ANSI/IEEE guidelines appear to have become a refuge for special interests for whom the very existence of health problems at athermal levels of exposure would have important consequences. For example, Fisher (1991) in his engineering review of microwave exposure levels encountered by police traffic radar operators concludes that "with a high degree of certainty, microwave exposure levels encountered by these operators is less than 1% of the maximum exposure level of 5 mW/cm^2 established in ANSI standard C95.1-1982. Because of this (sic) standards and the results of this experimental research, we are able to conclude with a high degree of certainty that there is no evidence to support the allegation that police traffic radar operators are at risk due to prolonged exposure to microwave emissions from their radar units."

Thus are uninformed engineering opinions on some of the most complex of medical problems foisted on an unsuspecting public.

8. Recommendations.

1. As an emergent general conclusion, it appears that cognate Federal regulatory agencies should assume direct responsibility for development and implementation of urgently needed safety guidelines for RF/microwave exposures. This had been a long-standing requirement, made more urgent if a national patchwork of separate state and local enactments is to be avoided. These tasks should not be left in the hands of private bodies, all too often susceptible to pressures of special interest groups.

2. Future developments in safety guidelines should encompass the highly credible body of information on athermal bioeffects, including effects of modulation patterns on RF/microwave fields, and growing evidence on biomolecular interactions with millimeter wave fields.

3. There is an urgent need for a national civilian research program on medical effects of RF/microwave exposures. This program should encompass both epidemiological and laboratory studies, with special emphasis on industrial and military exposures. This research initiative should recognize the importance of cooperative international efforts, particularly through mechanisms of the World Health Organization and related bodies, including the International Telecommunications Union and the International Union of Radio Sciences (URSI). It is pertinent that the German Government has recently developed a national program of fundamental bioelectromagnetic research through its prestigious Max Planck organization, with a strong focus on athermal millimeter wave interactions and acceptance of the physical principles enunciated in this testimony as a point of departure.

A Summary by Wayne

I hope Ross won't be irritated that I've edited out two full pages of references.

In case the language of Ross' testimony before the Senate was too obscure for you, what he said was that yes, police radar guns can cause cancer. And yes, cellular telephones can cause cancer, as can ham rigs, if you're not careful. This is the same stuff I've been telling you and has been resisted by some of our more obtuse brethren.

It does appear that a 2m HT probably won't cause much harm . . . unless you're running PL tones. Those are the real mischief makers.

The only standards we have have to do with power levels that cook our flesh. Research has now shown that power levels a million times weaker can harm us.

Number 8 on your Feedback card

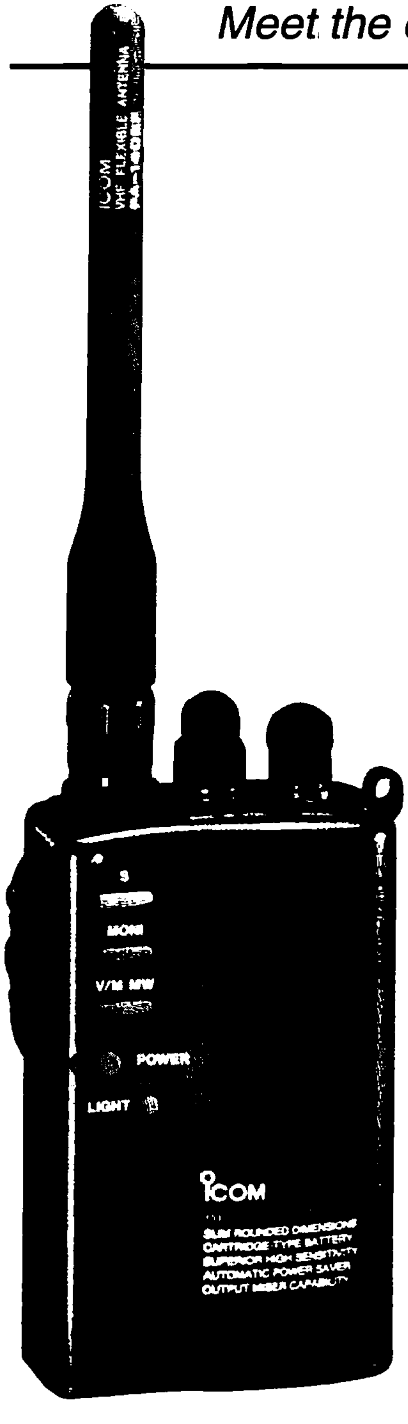
73 Review

by Michael Jay Geier KB1UM

The ICOM IC-2iA Micro HT

ICOM America, Inc.
2380 116th Ave N.E.
Bellevue WA 98004
Telephone: (206) 450-6088
Price Class: $380.

Meet the ever-shrinking HT.



What's that? You say you want a walkie small enough to drop into your pocket or purse without so much as a bulge? Today's walkies just aren't small enough to take with you wherever you go? Well, check out ICOM's new IC-2iA. There's a whole new generation of ultra-small HTs coming around, and ICOM has led the pack with this miniaturized model. This tiny radio sports the emerging new style of slide-in battery which fits into the bottom of the case, keeping the size of the rig to a minimum. Where's the radio? I've seen *microphones* bigger than this thing. At only 2.3" x 3.6" x 1.2", this is as small as it gets! And even with the battery pack installed, the whole shebang weighs only a little over nine ounces. With rigs this size, there's just no excuse for leaving them home.

Basics

This radio represents a new approach to HT operation. Rather than the usual array of buttons, this one has only seven of them to operate all the advanced functions we've come to expect in today's walkies. Plus, of course, the squelch, volume and rotary dial knobs are on top, just as with any HT. That's it! No DTMF keypad. My first reaction was, "Oh, no autopatch calls with this thing." I was wrong—you can program in up to 16 autodial memories and send them whenever you like. So how do you control all that stuff with only seven buttons? ICOM has developed what they refer to as "artificial Intelligence" modes. Essentially, they're menus which let you set up all the parameters. The AI twist refers to your ability to lock yourself out of what you don't feel ready to use. In fact, there's one mode in which the various features begin to appear gradually as you accumulate hours using the radio. As a seasoned ham, it's hard for me to judge the usefulness of such an approach, but, to a newcomer, it might be handy in avoiding contusion while learning gradually.

"There's a whole new generation of ultra-small HTs coming around, and ICOM has led the pack with this miniaturized model."

For such a tiny box, this radio does a lot. It transmits from 140-150 MHz, and the wideband receiver covers 138-174 MHz, taking in a fair amount of the public service band action. CTCSS encode/decode and DTMF paging functions are built in. In the easy mode, you get only 10 memories, but there actually are 100 of them, and they appear when you switch to the full-featured setting. The transmitter puts out 1 watt with the supplied battery. (At 13.8 volts, you get 5 watts out.) A watt is plenty for local repeater use, and the lower power output greatly helps conserve the battery, but it's less than most HTs put out. No current rating is printed on the battery pack, but in a separate list of available options I discovered that the 7.2 volt battery is rated at 400 mAh. That's about two-thirds the current capacity of most HT packs but, then, this radio is only about one-half to two-thirds the size of the average HT! Considering the size of the package, 400 mAh is not at all bad. If it's not enough for you, though, you can buy bigger packs which give you longer operating time or higher RF output power. You also can get a holder for 6 AA cells, so you can be sure of having power at all times. Of course, any of these options will make the radio a bit longer, but it still will be pretty darned small.

The LCD is quite large and the frequency is easy to read. Some of the icons are fairly small, but the most important stuff, like the memory channel number, stands out well. The buttons themselves are made of rubberized material, and they feel good, with distinct tactile feedback when pressed. Above the PTT is the function button, which lets you use the other buttons for multiple operations. There's a two-color LED which turns green when the squelch is open and red when you're transmitting. On the right side is a rubber cover, under which are the mike, earphone and external power input jacks. Overall, the rig seems especially weatherproof, except for where the battery enters.

The coaxial DC power input jack lets you run the rig on anything from 6 to 16 VDC,

which means you can use it on car power without a separate regulator. But don't think you're going to go down to Radio Shack and make up your own power cable, because ICOM has used a modified version of the coaxial jack I've never seen before. As far as I can tell, only their cord will fit. Also, unless you buy the quick-charger, you must charge the battery through this jack; there's no jack on the battery pack itself. This involves some inconvenience, as you can't use the rig while you're charging the battery, but it also has a point: The radio maintains the memories via an internal, rechargeable battery, which also gets charged when you charge the main battery. By the way, the backup battery will keep your data for about two months with no power applied, so it shouldn't be a problem unless you hardly ever use the rig.

The rubber duck antenna is one of the nicest I've ever seen. It's not much longer than the radio itself, which is a welcome change from some of the small rigs which have huge antennas. Also, this one's both thin and extremely flexible above the bottom inch and a half or so. A cool quacker. Also included are a hand strap, belt hook and, of course, a wall cube charger.

Getting Started

The IC-2iA jams virtually all the goodies, such as CTCSS, DTMF squelch and such, into this little box. As initially configured, you're locked out of most of the good stuff. At first, all you get are 10 memories and one VFO frequency. Nothing else—not even repeater offsets! This is because the radio's default state is something called "easy mode." Designed for rank beginners, easy mode just gives you the bare minimum for simplex operation. But, recognizing that nearly all VHF ham communications in the U.S. are via repeaters, ICOM explains, toward the end of the short manual, how to get into the full-featured mode long enough to pick an offset. They also tell you how to set a CTCSS tone frequency. Other than that, you are referred to a separate set of instructions called the "Tech Talk." I found no such Tech Talk with the review rig, so I called ICOM. Apparently, some early units were shipped without it, requiring you to get it through your dealer. They assured me, though, that current units all have the Tech Talk included.

The Tech Talk manuals are simple, well-written and illustrated instructions which show you how to use the various features available in the full-function mode. Now you can get to the 100 memories, set scan limits, scan type, power-on and power-off timers (the radio has a built-in clock), program phone numbers and autopatch codes (which include the A, B, C and D codes) into the autodialer, set up the DTMF code squelch options, change the battery saver interval, skip and hide memories, you name it. There are even settings for LCD contrast and turning off the green "receive" LED to save power.

The Menu Interface

Cramming all this stuff onto seven buttons was quite an achievement! The use of menus is a great help, and I suspect we'll see more walkies with this type of control. Basically, you hold the "S" button while turning the rotary dial knob and the radio steps through all the functions which are accessible with the menus. The sequences aren't hard to do, but keep the Tech Talk sheets handy until you memorize the most common sequences. Luckily, once you get everything into memory, it's a piece of cake to go to a memory channel and start talking.

The Modes

There are four modes:

1) Easy: You get 10 memories and a VFO frequency. That's it. But, if you've already set repeater offsets into those memories or the VFO from one of the advanced modes, they still work.

> ***"The IC-2iA jams virtually all the goodies, such as CTCSS, DTMF squelch and such, into this little box."***

2) "Growing-type" AI: At first, very few features appear. As you build up hours of use with the rig and perform the various operations you are given, you get more features.

3) "Select-type" AI: You get to pick which features you want to appear and which you don't. The functions are ordered into seven groups, each starting with a letter in the word "special." The display shows the letters of the selected groups. This could be handy if, for example, you never use DTMF squelch and would like its menus to go away, uncluttering the operation of the rig somewhat.

4) "All-type" AI: This is the full-function mode, and most users will want to leave it this way.

On the Air

Like most ICOM receivers, this one is quite sensitive, even well outside the ham band. Selectivity is fairly good; you can tell when you're 5 kHz off. (Some rigs are so wide you can't tell no matter how hard you try.) The case doesn't get very warm when transmitting with the 7.2 volt battery but, then, it shouldn't with a 1 watt transmitter. Still, transmit efficiency must be fairly decent or you'd feel it after a minute or so of key-down time.

The receive audio is a little tinny, but it's quite loud for such a small rig. In fact, it's significantly louder than my normal-sized HT, which is great for using the rig in the car. You might actually be able to hear this one at highway speeds.

The transmit audio is a different story. Every contact I made began with the other operator's saying something like, "Gee, your audio is pretty muffled. I can understand you, but it ain't great." I listened to it through my other walkie, and they weren't kidding. A call to ICOM confirmed that this model tends to be a bit bassy. Looking at the front panel, I could find no microphone hole! It turns out they use a channel in the plastic which picks up sound through the speaker holes and sends it to the mike. It seems to lose most of the higher frequencies.

At ICOM's suggestion, I even opened my rig to make sure the channel wasn't blocked by a stray bit of glue, but it was clear. They told me that some owners have drilled a little hole over the mike, giving it direct sonic access and dramatically improving the audio. If you decide to do this, I suggest you open the rig and remove the mike first, so you don't drill into it. You may not find it necessary, though. Even if you do sound a bit muffled, you certainly can be understood.

What I Liked

This thing is really small. With its nice, flexible antenna, it's easy to take it anywhere, even when you might leave a bigger radio home. Once all your data is programmed in, selecting memories and using them is easy. Setting a frequency into the VFO is fairly quick, too, despite the lack of direct keypad entry. The receive audio is nice and loud. Though not rich-sounding, it's very intelligible. Even with no keypad, you can send autopatch numbers.

What I Didn't Like

With something this new and different, it's reasonable to expect some bugs and problems. Here's what I found:

Despite the menu system, this radio is a bit harder to program than some other HTs. Controlling all those features with so few buttons was bound to make things messy. Without the large Tech Talk sheets by your side, you are bound to forget how to operate the more advanced functions. A wallet-sized cheat sheet is provided, but it covers only a few easy-mode functions. A complete one for the all-type AI mode would be very welcome.

Unlike on most HTs, there is no automatic repeater offset function. If you set a frequency into the VFO which requires a different offset direction than the previous one, you'll have to go to DUP mode to change the offset from + to - or vice versa, or even to select simplex.

Finally, you can't use the radio while the battery is charging, even if you have another battery pack or an AA cell holder, because the standard charger connects through the rig. It isn't clear from the illustrations whether you can put the supplied battery into the quick-charger without the radio; the drawing shows it going in while attached. With the bigger batteries, it appears you can, though.

Conclusion

The IC-2iA represents a bold move by ICOM to create a new generation of micro HTs. If you want a really small HT with all the features currently dreamed up, the IC-2iA just might fit your needs. You sure won't leave it home because it's too big to carry around!

73 Review

Number 10 on your Feedback card

by Arnie Johnson N1BAC

ICOM America, Inc.
2380 116th Ave. N.E.
Bellevue WA 98004
Telephone: (206) 450-6088
Price Class: $1,800

The ICOM IC-737 HF All-Band Transceiver

A first-class rig, with all the right features.

How many of you have ever wanted to upgrade your HF equipment but became confused by all of the features different manufacturers offer? Size and shape? Bells and whistles? Will it do this or that? Can I use it mobile? How forgiving is it to operate at a high SWR into the wet noodle antenna hanging out the window? And the final, ever-present question: *How much*?

Of course, there are many more questions we tend to ask when we are mortgaging the wife and kids to purchase that new HF rig and one of the biggest is: Is it worth it? Let's find out.

Any radio I get my hands makes me to wonder about many things: the ability to use the radio as my base rig or take it mobile; whether or not there's a built-in antenna tuner; the ability to operate SSB, CW, AM, FM, and RTTY/AMTOR/packet; ease of operation; number of memories; etc.

Thanks to being in the right place at the right time (in the *73* office when a big box from ICOM came in addressed to Associate Publisher David Cassidy N1GPH), I got a chance to use and review one of ICOM's latest and greatest pieces of HF equipment, the IC-737. I almost asked to borrow David's Outbacker mobile antenna to use it on the way home, but figured I might be pressing my luck a bit too much (a bird in the hand is worth two in the bush, etc.), so I had to wait until I got home.

My wife gave me that "not another toy" look as I brought the box into the house, but seemed a bit happier when I told her that I hadn't bought it but was reviewing it for *73*.

First Impressions

As I opened the box, I was pleased to see that ICOM packed the equipment as well as they did many years ago when I bought my last new radio. Enclosed was the radio (with carrying handle on the side, just like my IC-701), and inside another smaller box were the hand microphone, stereo plug (for CW operation), DC power cable, and two fuses (20A for the power cable and 4A for internal circuitry in the PA), and "Yes, Virginia, ICOM still fuses both the positive and negative power leads."

One of the first things I do when I see a new radio is look at the labels on the front panel to see if I can figure them out without having to open the instruction manual (heaven forbid). Of the 48 buttons and 11 knobs, I only had questions on the operation of five buttons. I don't think that's too bad for a new state-of-the-art radio.

It didn't appear that those unknown buttons should stop me from firing up the IC-737, so I connected the hand mike, hooked the DC power cord to my 20A Astron, connected the DC cable to the back of the rig, and took my triband beam antenna coax from its switch box and started to screw it on the back of the rig. That's where I ran into a little problem: The IC-737 has two coax connectors on the back. What's up, Doc? Well, the ANT 2 receptacle had a plastic cover on it, so I hooked my beam up to ANT 1. That answered a question on one of unknown buttons on the front panel, a choice of Antenna 1 or 2. More on this later.

Power switch ON. No smoke, just normal sounds out of the speaker on the top of the radio. The frequency tuning knob in the front center had a nice free feel to it as I moved through the band. Volume control offered a nice range of audio and the outer knob squelch worked fine. Many operators have large fingers, but I think the size of the knobs will allow everyone to use them easily. The only two that might be a bit small are the RF PWR and COMP LEVEL, which don't get changed too much anyway—just set 'em and forget 'em at max smoke and mid-point.

Testing

Because I had moved out of my beam antenna's 2:1 area I figured I would test the internal antenna tuner's ability to bring my antenna back into range. I selected TUNER and was happy to see a small light in the button come on to show selection. I then touched

Continued on page 46

The ICOM IC-737

Continued from page 44

the TUNE button, noticed needle movement on the combination S/RF meter, and watched the indications show tuning. As advertised (I peeked in the book for the times), in less than seven seconds, probably more like three seconds, it was tuned to 1:1. That's neat! I love it! Certainly faster than my trusty faithful old companion three-knob Dentron Super Tuner.

I decided to see what the rest of the bands would do, so I took a stab at UP and DOWN buttons to change bands. That worked also, but at 1 MHz steps. I also heard some whirring and figured that the automatic antenna tuner was making corrections on the fly, at least to get close. This isn't so bad, I thought.

Next was the use of the number buttons on the pad, listed as 1.8 (1), 3.5 (2), 7 (3), 10 (4), 14 (5), 18 (6), 21 (7), 24.5 (8), 28 (9), and 29 (0). Each button pushed took me to a frequency in that band and the proper mode. This radio is a piece of cake to operate!

The next button I tried was the FREQ-INP. I typed in the desired frequency on the number pad, pressed ENT, and there I was. This is too easy!

Since neither my IC-701 nor Atlas 210X have the WARC bands, I decided to hook up my 160m dipole to the ANT 2 connector and see what was happening. When I tried to select Antenna 2 on the front panel, nothing happened. Finally, I had run into something that forced me to open the Instruction Manual. After looking at all the pages about antennas listed in the index and not finding what to do, I started looking page-by-page. I finally found something called "set mode operation" that allowed changes in programming to be made in 13 different items, and one of those was activating the antenna switch. It was very simple, even for me. You can choose OFF (switch not activated), ON (switch activated for manual use), and AUT (switch activated and the band memory memorizes the selected antenna). This is too easy; my kind of radio! Of course, I selected AUTo.

As expected, once Antenna 2 was selected, the tuning worked great on all bands using my 160m dipole. This took a little longer on 10m (my Dentron can't get it below 1.6:1), but did fine.

Most of the other buttons were self-explanatory: POWER, TRANS, BK-IN, FULL, PREAMP, ATT, AGC, NB, COMP RIT, TX, NOTCH, SSB, CW/N, AM, FM/TONE, LOCK, A/B, A=B, SPLIT. Many of these buttons have little lights in them to show selection. The knobs were also self-explanatory: AF, SQL, MIC, KEY SPEED, RF PWR, COMP LEVEL, RIT/TX, NOTCH, M-CH, PBT.

After attempting to memorize some frequencies into memories, I decided discretion was the better part of valor (I was beginning to look dumb, even to myself), so I looked in the very informative Instruction Manual again, and found that it's not really that hard (maybe I'm not so dumb after all). I just wasn't pushing the MW (Memory Write) long enough (one second). It's actually quite simple: 1. Set the desired frequency and operating mode in the VFO mode; 2. Rotate M-CH (Memory Channel) to select the desired memory channel to be programmed; 3. Push and hold MW for one second to program the displayed frequency and operating mode into the memory channel. To check the programmed contents, push VFO/MEMO to select the memory mode.

Channels 1-89 are regular memory channels with one frequency and one mode in each channel; channels 90-99 are split memory channels which allow independent transmit and receive frequencies and operating modes in each channel for split frequency operation (FM repeaters on 10m); and channels P1 and P2 are scan edge memory channels which allow one frequency and one mode in each memory channel as scan edges for programmed scan.

The IC-737 also allows for three different methods of frequency scanning: Programmed Scan repeatedly scans between two scan edge frequencies (P1 and P2); Memory Scan repeatedly scans ALL programmed memory channels; and Selected Memory Scan repeatedly scans all SELECTED memory channels.

UPDATES

Number 11 on your Feedback card

Using the World's Most Accurate Frequency Standard

With regard to the above mentioned series which appeared in the January, February, and March 1994 issues, please note the following:

1. On all circuit boards, the transistor outlines inked on top of the boards for NPN transistors are not for the 2N2222 types. The author suggests using either the 2N3904 or 2N4123 types. The 2N2222s will work if you bend the base lead back between the other leads so they are mounted correctly.

2. For the 1 MHz oscillator (Part 3), il you have trouble getting enough output, add a 56k resistor from the base of Q8 to +8 volts. If the output is still inadequate, reduce the AGC by adding a 100k resistor across C11.

Getting Started With Satellite Imagery

In connection with the above mentioned article (March 1994, page 14), we listed a number ol vendor addresses. Among these was the (former) address for Software Systems Consulting. Please contact SSC at their current address: Software Systems Consulting, 615 S. El Camino Real, San Clemente, CA 92672.

HAM HELP

Number 12 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11 (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters L or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

WANTED: Donations, suggestions, new members. ATOM, Amateur Television ol Manchester is a new group organizing to help educate, experiment, and increase local activity on ATV in New Hampshire and New England. *ATOM, 175 Crosbie St., Manchester NH 03104.*

WANTED: Manual (or copy) for ICOM IC-02AT 2 meter. I also need the operator's instruction manual (or copy) for YAESU FV 102DM VFO, and REALISTIC Comp-100P programmable memory scanning receiver. I will pay for the manual or copying lees. *Vincent Lopez NP4MZ, 60 Moore St. Apt. 5J, Brooklyn NY 11206.*

I would like to get in touch with anyone who knows how to modify the UNIDEN HR2600 lor ORP operation. *Jim N9KXB, 5748 N. Campbell #3, Chicago IL 60659.*

I have liberated an HW-5400 transceiver from the clutches ol a CB'r who had "modified" the 10 meter band. I need the HEATH construction manual with schematics on this unit in order to retum it to Amateur status. Original, zerox, etc., ok. I will pay your costs, or buy if you want to sell. *John A. Callahan KR5K, 340 E Gaywood, Houston TX 77079. Tel. (713) 461-6704.*

CIRCLE 145 ON READER SERVICE CARD

CIRCLE 197 ON READER SERVICE CARD

Actual Use

No review is worth its salt if nothing is said about the ability of the transmitter and receiver to do their parts. I do not have any test equipment, so I will leave it up to ICOM to be honest in its representation as shown in the Specifications sidebar. The proof is in the pudding, though, and the IC-737 talks with ICOM's usual fine audio quality, even under compression, and listens just fine. No surprises there. What I could hear, I could usually work, except in the pileups with the "Big Guns." The NOTCH and PBT (Pass Band Tuning) were certainly able to do their intended jobs.

Connectors

Another important part of any radio is its ability to support external devices, such as connecting to a linear amplifier, a TNC for data communications, etc. The IC-737's back panel is composed of the two antenna connectors, a ground bolt with a wing nut, a connector for an external speaker, an electronic keyer switch that turns the Internal electronic keyer ON and OFF, a CW semi-break-in delay control, a CW key jack, two accessory sockets (7- and 8-pin), an ALC input jack, a send control jack (this goes to ground while transmitting to control external equipment, such as a linear amplifier), an AH-3 control socket (external antenna tuner), a DC power socket, and a CI-V remote control jack (use with a personal computer for remote operation of transceiver functions). Lots of support!

The Instruction Manual

And last, but certainly not least, the 60-page Instruction Manual. I must say that it is written very well, in a manner that makes each page worth reading to discover the many other capabilities of the IC-737 not mentioned in this review. Also included are two large separate folded sheets of schematic diagrams. It might still take a magnifying glass to check the components (at least with my eyes), but they are all there for those who want to know what makes it tick or just can't keep their fingers off the internal goodies.

Optional Features

Optional items available for the IC-737 include CW narrow filters, 500 and 250 Hz/-6 dB for both the 455 kHz (third IF) and the 9.0106 MHz (2nd IF); a UT-30 programmable tone encoder unit; a CR-282 high-stability crystal unit; and an MB-49 mobile mounting bracket; as well as all the rest of the optional items such as power supplies, microphones, etc.

The worst part of this review was knowing that David remembered who he gave the IC-737 to, and that I'd have to give it back to him. It's difficult to give up a quality well-built radio like this, but if I do, maybe he will let me do another radio review in the future.

I only have one more thing to say about the ICOM IC-737: "Try it—you'll like it!" I did!

IC-737 Specifications

Frequency Range		
	Receive	500 kHz-29.995 MHz
	Transmit	1.800-1.99900 MHz
		3.500-4.000 MHz
		7.000-7.300 MHz
		10.100-10.150 MHz
		14.000-14.350 MHz
		18.068-18.168 MHz
		21.000-21.450 MHz
		24.890-24.990 MHz
		28.000-29.700 MHz
Mode	SSB, CW, AM, FM	
Memory Channels	101	
Antenna Impedance	50 ohm nominal	
Usable Temperature Range	-10°C +60°C	
	+14°F +140°F	
Frequency Stability	Less than +/-200 Hz from 1 min. to 60 min. after power ON. After that, rate of stability change is less than +/-30 Hz/hr. at +25°C; +77°F. Temperature fluctuations (0°C to +50°C; +32°F to +122°F) less than +/- 350 Hz.	
Power Supply Requirement	13.8 V DC +/-15% (20A)	
Current drain	Transmit	20A
	Receive squelched	1.6A
Max audio output	2.1A	
Dimensions	330(W) x 111(H) x 285(D) mm	
	13.0(W) x 4.4(H) x 11.2(D) in	
Weight	8.05 kg; 17.7 lb.	
Transmitter		
Output power	SSB,CW,FM	10 to 100 watts
	AM	10 to 40 watts
Spurious emissions	Less than -50 dB	
Carrier suppression	More than 40 dB	
Unwanted sideband	More than 50 dB	
Microphone impedance	600 ohms	
Receiver		
Receive system	Triple-conversion superheterodyne	
Sensitivity (Preamp ON)	0.5-1.8 MHz	AM
Less than 13.0 µV for 10 dB S/N		
	1.8-29.995 MHz	SSB, CW
Less than 0.16 µV for 10 dB S/N		
		AM
Less than 2.0 µV for 10 dB S/N		
		FM (28-29.7 MHz)
Less than 0.5 µV for 12 dB S/N		
Squelch sensitivity	SSB	Less than 5.6 µV at threshold
	FM	Less than 0.3 µV at threshold
Sensitivity	SSB, CW	More than 2.1 kHz/-6 dB
		Less than 4.0 kHz/-60 dB
	AM	More than 6.0 kHz/-6 dB
		Less than 20.0 kHz/-40 dB
	FM	More than 12.0 kHz/-6 dB
		Less than 30.0 kHz/-50 dB
Spurious and image rejection ratio	More than 70 dB	
Audio output power load	More than 2.6W with a 10% distortion and an 8 ohm	
RIT/TX variable range	+/- 2.5 kHz max.	
Antenna Tuner		
Matching Impedance range:	16.7-150 ohm unbalanced (VSWR less than 3:1)	
Min. operating input power	8W	
Waiting time for band changing	Less than 3 seconds	
Tuning time	Less than 7 seconds	
Tuning accuracy	VSWR 1.5:1 or less	
Insertion loss (after tuning)	Less than 1.0 dB	

73 Review

Number 9 on your Feedback card

by Charles Warrington WA1RZW

The Ham Contact
P.O. Box 3624, Dept. 73
Long Beach CA 90803
Telephone: (310) 433-5860; (800) 933-HAM4
Price Class: $49.95 (plus $8.50 shipping)

The Power Station

A multi-function, portable, rechargeable power source.

Just think of all the devices you can run from your car's cigarette lighter outlet these days. There are HTs and HF rigs, CD players and spotlights, shavers and soldering irons, refrigerators and coffee pots—even power tools. Now, with cigarette smoking's fall from fashion, auto-makers will probably soon begin calling these "accessory power outlets," or possibly replace the lighter itself with a simple protective cover. Instead of a smoldering butt symbol you might instead see a symbol for a battery or the word "ACCESSORY." What started out as a way to light up your smokes has evolved into an all-purpose power source.

Too bad your car isn't all that handy at times. So, with a bevy of gadgets tethered to your dash, wouldn't it be nice if you could just yank that little outlet and *take it with you* when you need it? How about camping? Or fishing? Or just operating your HT at your home QTH at high power like a base station?

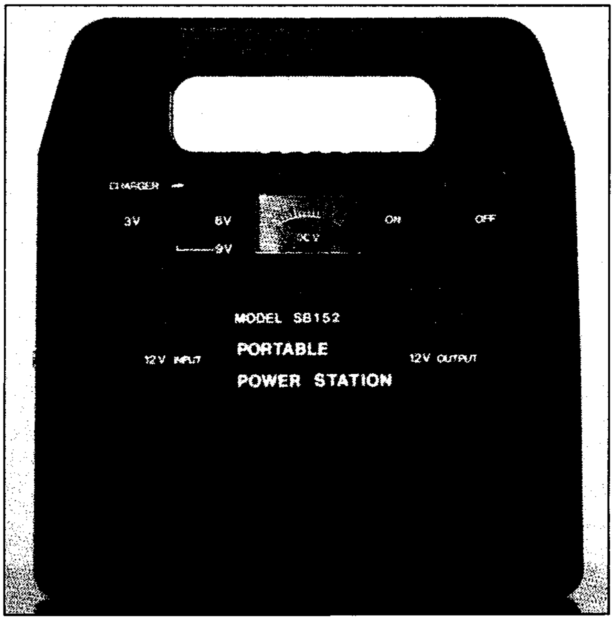
Well, wish no more, because the folks at The Ham Contact are now importing and distributing the Power Station—a slick little rechargeable gell cell battery source that you can take with you anywhere. Let's take a look at what the Power Station has to offer.

Features

The heart of the Power Station is a 7.0 amp-hour rechargeable gell cell battery. By means of comparison, the NiCd battery in your HT is probably rated at 400 or 600 mAh. Thus, you could multiply the life of your HT battery by about 14 times, just to give you an idea. And, while nickel cadmium batteries suffer the dreaded memory effect, these gell cells do not.

The unit is shipped complete with a wall charger, and the *CHARGE* light blinks when the unit is fully charged. Also included is an 8-foot double-ended cigarette lighter cord. This allows you to recharge the Power Station from your automobile battery when you are on the road.

The output is switchable from 12 volts to 9 volts to 6 volts to 3 volts—four output levels to accommodate a wide variety of devices. The 3, 6, and 9 volt output is at a 3.5 mm coaxial jack on the side of the unit; the 12 volt output is available at the female cigarette lighter socket and at the output studs under the back cover. You can draw current from any or all at the same time.



The voltmeter on the front of the Power Station normally reads output voltage, but it can also read the condition of a car battery when the lighter plug-to-lighter plug cord is used.

A Good Idea

I felt some sense of comfort during the horrendous ice and snowstorms we suffered recently here in New England knowing that I had some method of dependable back-up communications. The Power Station was also mighty nice to have when the lights went out, since I happen to own a 12 volt halogen spotlight and a 12 volt television set, and both are equipped with cigarette lighter plugs.

Another advantage to owning one of these units is realized when your car battery begins to give up. The Power Station can be helpful in two ways: as a charger and as a booster.

In very cold weather, you can run jumper cables from the Power Station to your car battery and give it a quick charge before starting. Or, you can pull up to 100 amps from the Power Station for just a matter of seconds—long enough to jump start the old jalopy. While the 12 volt output cigarette lighter socket is fused at 10 amps, the 12 volt output at the studs under the rear cover is not fused—permitting short bursts of high current.

Conclusions

The Power Station would be a welcome addition to any ham shack. It is a quality product constructed of heavy-duty ABS plastic and is UL approved. The unit can be recharged from a standard wall socket in about eight hours, or from your car's cigarette lighter socket in about three hours (with the engine running).

The Power Station is truly portable at about 7.5 pounds and measuring approximately 7.5" x 2.5" x 8". The charging circuit shuts off automatically to prevent overcharging. The voltage-sensing circuitry protects the unit and extends its life. You can run all three outputs at the same time, at two different voltages, making this a versatile unit.

You will also enjoy the instruction manual. The translation from Chinese is often humorous. Still, the information is easily understood. Add a multiple outlet adapter like Radio Shack's 270-1544 to the Power Station and go nuts! I wish they had these when we were kids. It sure would have livened up the old tree house.

Improved QRP Keying Circuit

A slick fix for your little CW rig.

by Steven Weber KD1JV

If you've ever built a simple QRP transmitter, the keying circuit you used probably looks something like the one shown in Figure 1a. If you look at the wave shape of the RF output of your transmitter with a scope, you will see just slightly rounded edges on the signal as you key. Also, if you trigger your scope upon key closure, you will notice it takes a few milliseconds before you even get an output. Why does this happen?

Referring back to Figure 1a, when you close the key, capacitor C1 starts to discharge through resistor R1. At some point enough charge is taken from the capacitor and current starts to flow through the emitter of Q1, starting to turn it on and supplying power to your amplifiers. The amount of time it takes for Q1 to start to turn on after key closure is hard to say as the voltage across C1 does not follow the normal RC discharge curve. It only has to discharge enough to start to turn on the transistor and then the gain of the transistor modifies the curve. An additional delay is caused by the fact that the RF amplifiers don't start to turn on until there is 2 to 3 volts across them. By the time you start to get any signal out of your transmitter, a significant amount of time has gone by since key closure and Q1 is well on its way to being fully turned on.

When you release your key, C1 charges very quickly through the emitter-base diode junction of Q1. To slow down the turn off time a fairly large capacitor, C2, is added to the circuit. This gives the trailing edge of the keyed signal a shape closer to what you would expect to see. However, it takes a few milliseconds before C2 charges up enough to start to turn Q1 off, again creating a delay.

"So what?" you might ask. Well, it's not much of a problem with real low-power rigs, but when you get up to 5 or more watts of output power serious key clicks may be heard. If you try to round out the leading edge by increasing the value of CI there will be even more of a delay between key down and signal output. This can make for clipped dots when sending at faster code speeds, making for very difficult copy on the other end of the QSO.

A Better Idea

I developed the circuit shown in Figure 1b to solve these problems for my 20 watt 40 meter transmitter.

Op amp U2b is a basic inverting amplifier with a gain of one. The capacitor C5 across the feedback resistor R11 makes it an integrator. The RC time constant of R11 and C5 determine the ramp time. The values shown will produce a 5 ms ramp. Use a good-quality capacitor for C5, such as a mylar or polypropylene type. A power transistor is placed inside the feedback loop so that the circuit can supply several hundred milliamperes of current. Control P2 sets the stand-by output voltage as seen at the emitter of Q2. U2a buffers the voltage from P2. This isolates the pot from the input of the integrator. With your key up, adjust the pot until you just start to see an output from your transmitter, then back off a little. Typically this will be between 2 and 4 volts. Your output signal will now have the proper 5 ms leading and falling edges and there will be no delay between key closure and the start of the output signal.

You must supply the op amp and collector of Q2 with at least 15 volts to produce a full 12 volts output on the emitter.

One-Chip CMOS Delayed T/R Control Circuit

In Figure 1b, when the code key is closed, the output of CMOS NAND gate A goes high, charging cap C3 through D1. The output of gate C then goes high, activating the T/R relay and the oscillator/mixer/or VFO offset. One input to gate D is slightly delayed to allow the relay and oscillator or VFO to settle before the initial keying of the amplifiers. When the key is released, the cap C3 starts to discharge through R2, P1. If the key is not closed again before C3 discharges to 1/2 of Vcc, the T/R relay will open and switch you back to receive.

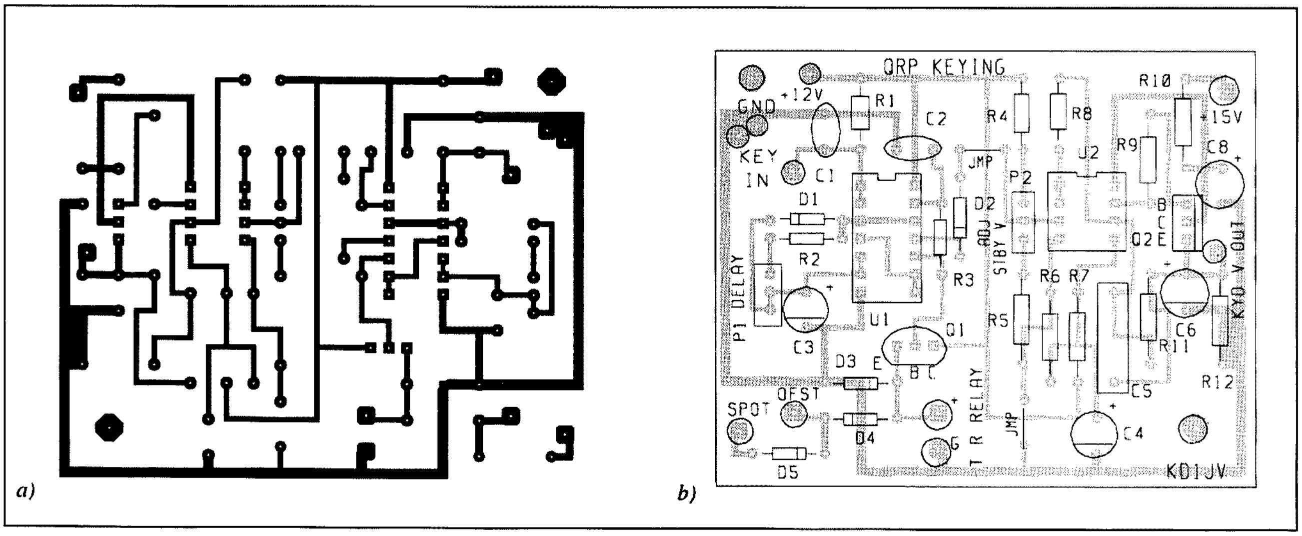


Figure 2. Improved QRP Keying Circuit PC board and parts placement diagram.

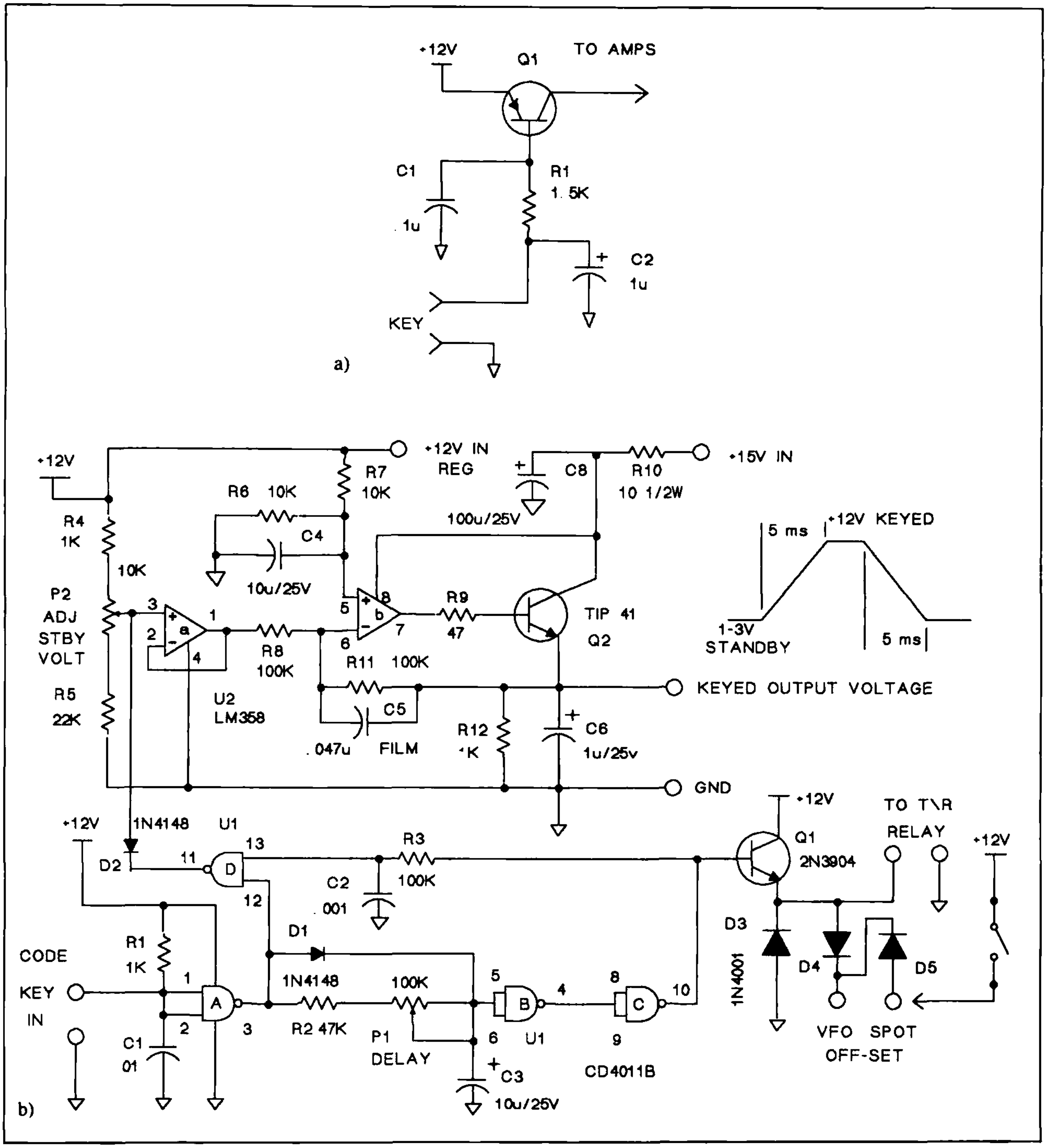


Figure 1.a) Typical QRP keying circuit; b) Improved QRP Keying Circuit with CMOS T/R keying control.

Parts List

R1,4,12	1k 1/4W	C1	0.01 µF disk cap	Q1	2N3904 NPN
R2	47k 1/4W	C2	0.001 µF disk	Q2	Tip 41-to-220 NPN
R3,8,11	100k	C3,4	10 µF/25V electro	U1	4011B CMOS NAND gates
R5	22k	C5	0.047 µF poly-film type	U2	LM358 dual op amp
R6,7	10k	C6	1 µF/25V electro		
R9	47 ohm	C7	Skipped		
R10	10 ohm	C8	100 µF/26V electro		
P1	100k or 500k trimpot	D1,2	1N4148 diode		
P2	10k trimpot	D3,4,5	1N4001 1A diode		

Drilled and etched PC boards are available for $4 plus $1.50 S & H per order from FAR Circuits, 18N649 Field Court, Dundee, IL 60118.

Number 14 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083

The Return of DOVE

Just over four years ago, on January 21, 1990, four small cube-shaped satellites were launched from the Kourou, French Guyana, spaceport as secondary passengers on an Ariane rocket. They began a new era in amateur-radio satellite communications. Among them was DOVE, the Digital Orbiting Voice Encoder. It would soon become known as DOVE-OSCAR-17.

DOVE is small, measuring only 10 inches on each side, and weighing just over 20 pounds. The satellite is composed of aluminum trays formed into a stack tied together with stainless-steel bolts and covered with solar cells for power. The internal trays contain the command receiver, flight computer, power module with batteries, S-band (2401.220 MHz) transmitter, AX.25 packet TNC (terminal node controller), digital-to-analog converter system, voice synthesizer and the 2 meter FM transmitters.

A 25-conductor ribbon cable runs between the modules carrying power, digital data, control signals and analog voltages from the various telemetry sensors. Each module has its own AART (Addressable Asynchronous Receiver/Transmitter). The inter-module communication runs at 4800 bps (bits per second) and has been described as a six-inch-long LAN (Local Area Network).

DOVE's mission is to transmit voice messages for educational and scientific purposes. The project was first proposed by Junior Torres de Castro PY2BJO. Junior is President of BRAMSAT (Sociedade Brasileira de Satelite Amador), the Brazilian counterpart of AMSAT-NA (The Radio Amateur Satellite Corporation), and is also a member of the Board of Directors of AMSAT-NA. Junior and BRAMSAT sponsored the program and paid for the satellite which was built in Colorado during the late 1980s. Junior was knighted by the president of Brazil for his contribution to the welfare of Brazil through the DOVE project.

During early software development efforts after launch the 2 meter transmitter became stuck in the ON condition. Usually the transmitter cycles to allow time for uplink commands. With the transmitter on continuously, DOVE's 2 meter command receiver was severely desensitized. Thanks to the efforts of W5UN and his extremely high ERP (effective radiated power) moonbounce station, a reset signal was forced into the command receiver during a period when the satellite's transmitter power was low due to low battery voltage. DOVE had been saved from potential disaster. The heavy cycling of the batteries could have caused irreversible damage to the power system.

In 1991 and 1992 students at the Chaminade College Preparatory School used DOVE for classroom projects. DOVE was beginning to meet its potential through educational efforts. A number of curriculum packages were developed at the school to teach science principles.

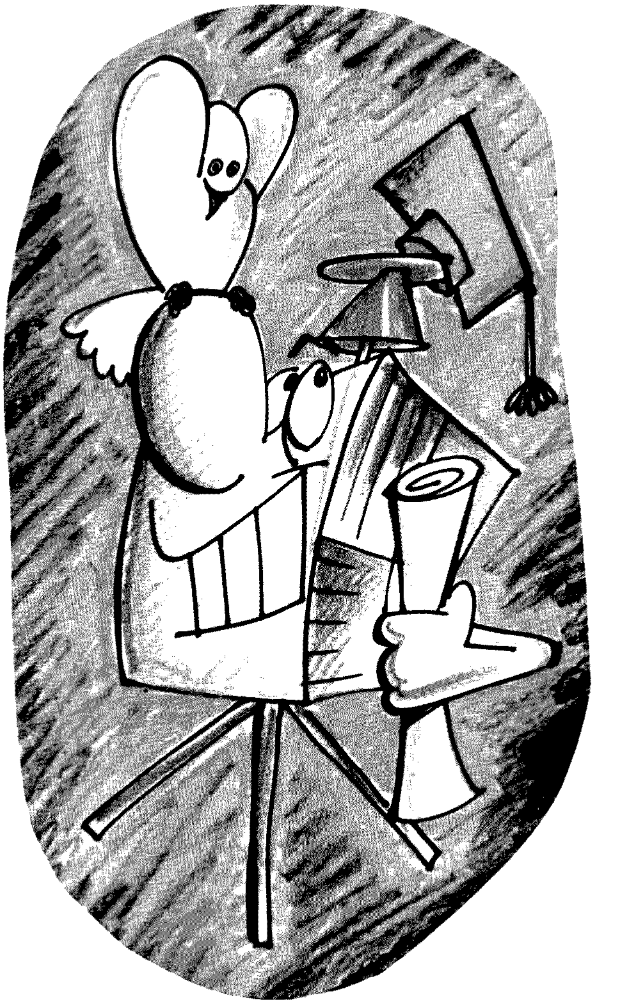


Photo A. The DOVE-Oscar-17 QSL from PY2BJO and BRAMSAT.

Photo B. Junior Torres de Castro PY2BJO was knighted by the President of Brazil for his contributions to the country regarding DOVE.

DOVE Talks

On May 24, 1992, strange voice signals could be heard on DOVE's 145.825 MHz FM downlink in between the bursts of packet telemetry. Sounding like the Colossus computer in the movie "The Forbin Project," the satellite was speaking a short sentence, "You are listening to Dove microsat." Command stations on the ground had sent code to the SC-02 voice synthesizer unit (now called the Arctic Technologies 263A) to activate the voice output. It worked, but after a few days the message became garbled. Since then the voice capability has been expanded, but the synthesizer does not represent the full voice capability of DOVE.

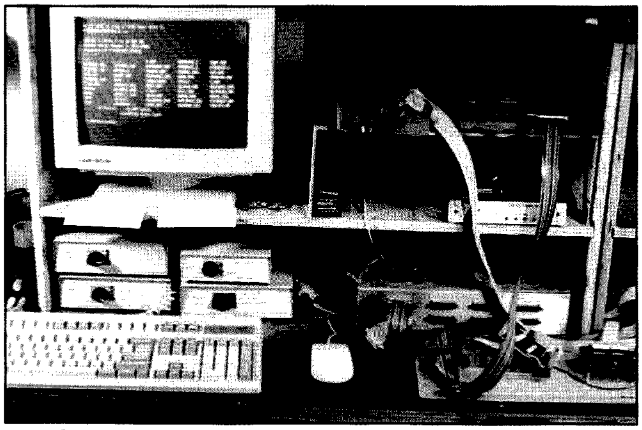


Photo C. The Microsat/DOVE simulator at WDØE requires several circuits and devices. (WDØE photo.)

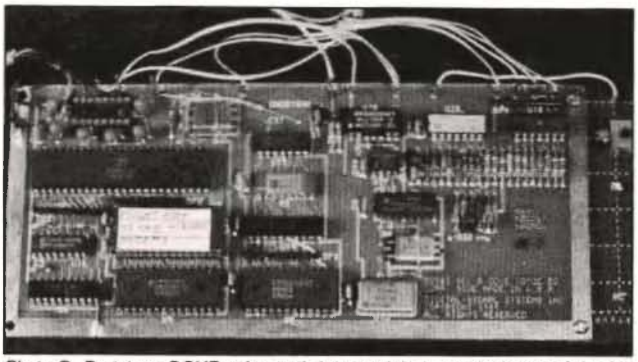


Photo D. Prototype DOVE voice and data module is used as part of the Microsat/DOVE simulator. (WDØE photo.)

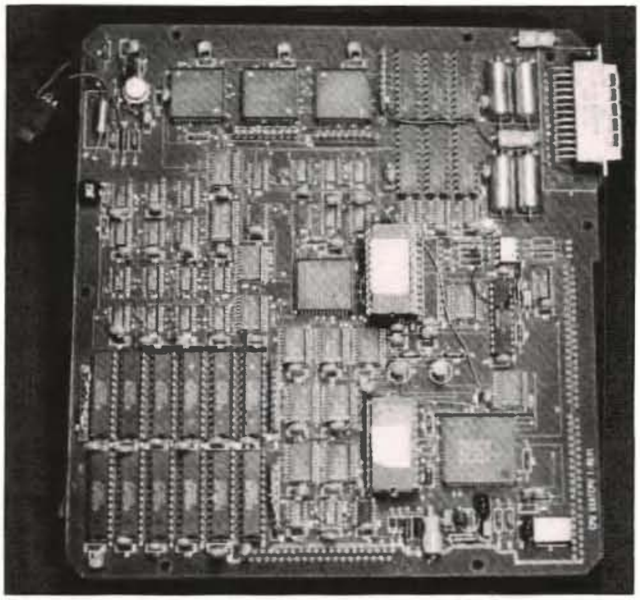


Photo E. Microsat software testing is done on a microsat CPU board like this one at WDØE. (WDØE photo.)

The unused digital-to-analog converter system was designed to allow uploaded digitized voice to be sent with fidelity close to the original recording. Work continues to bring this function online but no guarantees or estimates are possible since this is a volunteer effort.

The Failures

Since launch there have been some hardware problems that have made life difficult for the recovery team and ground controllers. The locked-on transmitter event earlier in DOVE's life could have destroyed the batteries. It is uncertain if the satellite could survive a repeat of that incident. Elaborate software watchdog timers have been implemented in the programming; with hope, this will help to avoid a future occurrence.

The AART communications chip on the module tray containing the voice system is not operating correctly. It can receive and act on instructions sent to it, but cannot respond back through the satellite LAN. This has required that programmers not demand any digital response from the voice unit to acknowledge commands.

Carrier suppression of the S-band 2.4 GHz transmitter failed completely. This means that the transmitter's signal can be easily detected, but the data carried by the modulation is

difficult to detect. It is 20 dB below the carrier. An open capacitor may be the culprit, but there is no way to fix it. Using the S-band receive system of Bill McCaa KØRZ, in conjunction with DSP (digital signal processing) techniques, the low modulation levels have been received well enough to decode some of the S-band packets.

The temperature sensor on battery two is bad. This is more of an annoyance than a problem. It is only mentioned since someone monitoring the telemetry might get worried by the high values associated with this parameter.

DOVE Today

Extensive effort by the satellite's designers, builders and the current team of ground controllers has been needed to circumvent DOVE's problems. The result, four years after launch, is a functional satellite with a lot of potential. Key volunteers in the recovery team include Harold Price NK6K, Jim White WDØE, Bob Diersing N5AHD and Bill McCaa KØRZ. For day-to-day operation the lead command station is Richard Howlett VK7ZBX, with help from Russ Piatt WJ9F. DOVE can be heard on 145.825 MHz FM sending standard AX.25 packet at 1200 bps. The signals are strong and can be heard on a handie-talkie. A typical home station set up for packet operation can easily detect and copy the messages and telemetry sent by DOVE.

The simplest approach to DOVE monitoring is to leave your packet station on 145.825 MHz and set your computer's communications program to a capture mode. Depending on your location there will be four to six passes above your horizon in a 24-hour period. After a day of monitoring, check the capture file for data. It may look something like that shown in Figure 1. Using information from Figures 2, 3, 4 and 5, this data can be deciphered.

A more sophisticated approach to telemetry capture is to use a computer with a satellite-tracking program to determine when the satellite is above the horizon, then tune for Doppler shift, use a beam antenna and collect the data on a PC with TLMDC-II, Whats- Up by G3ZCZ, or another microsat telemetry program.

Several satellite-tracking programs have been available as shareware and there are other good ones for sale. A source of commercial software is AMSAT at (301) 589-6062. One of their simpler PC track-

```
DOVE-1>BCRXMT-0 Sun Mar 06 05:51:38 1994
vmax=759160 battop=766771 temp=357713
DOVE-1>LSTAT-0 Sun Mar 06 05:51:39 1994
I P:0x3000 o:0 1:13884 f:13884, d:0 st:0
SWITCH-0>SWITCH-0 DM
DOVE-1>TIME-1 Sun Mar 06 05:52:01 1994
PHT: uptime is 119/11:39:04. Time is Sun Mar 06 05:52:20 1994
SWITCH-0>SWITCH-0 DM
DOVE-1>TLM-0 Sun Mar 06 05:52:05 1994
00:58 01:58 02:85 03:30 04:57 05:58 06:6C 07:54 08:6B 09:74 0A:A0
0B:E2 0C:E8 0D:D6 0E:00 0F:24 10:CD 11:A4 12:00 13:02 14:A8 15:95
16:96 17:92 18:94 19:94 1A:91 1B:8C 1C:98 1D:91 1E:25 1F:5C 20:B2
DOVE-1>TLM-0 Sun Mar 06 05:52:06 1994
21:9C 22:19 23:18 24:15 25:34 26:00 27:00 28:00 29:00 2A:00 2B:00
2C:00 2D:28 2E:00 2F:9F 30:CC 31:9E 32:00 33:00 34:C0 35:A4 36:AA
37:A8 38:B2
DOVE-1>STATUS-0 Sun Mar 06 05:52:06 1994
80 00 00 1E 41 18 CC 02 00 50 00 00 0A 0F 3C 05 17 00 0F 04 01
DOVE-1>_STAT-0 Sun Mar 06 05:52:06 1994
I P:0x3000 o:0 1:13884 f:13884, d:0 st:0
SWITCH-0>SWITCH-0 DM
DOVE-1>TIME-1 Sun Mar 06 05:52:31 1994
PHT: uptime is 119/11:39:34. Time is Sun Mar 06 05:52:50 1994
SWITCH-0>SWITCH-0 DM
DOVE-1>TLM-0 Sun Mar 06 05:52:35 1994
00:58 01:58 02:85 03:30 04:58 05:58 06:6C 07:54 08:6C 09:72 0A:9F
0B:E0 0C:E8 0D:D6 0E:00 0F:24 10:CC 11:A4 12:00 13:01 14:A8 15:96
16:8F 17:94 18:92 19:94 1A:92 1B:8C 1C:98 1D:92 1E:24 1F:5C 20:B0
DOVE-1>TLM-0 Sun Mar 06 05:52:36 1994
21:9D 22:19 23:18 24:14 25:34 26:00 27:00 28:01 29:00 2A:00 2B:00
2C:00 2D:28 2E:00 2F:9E 30:CC 31:9E 32:01 33:00 34:C0 35:A4 36:AA
37:A9 38:B2
DOVE-1>STATUS-0 Sun Mar 06 05:52:36 1994
80 00 00 1E 41 18 CC 02 00 50 00 00 0A 0F 3C 05 17 00 0F 04 01
DOVE-1>BRAMST-0 Sun Mar 06 05:52:38 1994
3rd March 1994
DOVE reports have been received from:
Will Marchant        Richard Emerson
Steven Bible         Dave Reeves
Gilbert Mackall      Jim Lyons
Dorothy Baker        Paul Wiliamson
These will change in 3 Days.
[vk7zbx]
```

Figure 1. Sample of recent DOVE packet telemetry.

Equations are in the form: Y = A*Nr + B*N + C where:
N = Telemetry Count (00 - FF)
A, B, C = Equation Coefficients
Y = Result (In Specified Units)

HEX	Description	C	B	A	Units
0	Rx E/F Audio(W)	+0.000	+0.0246	0.000	V(p-p)
1	Rx E/F Audio(N)	+0.000	+0.0246	0.000	V(p-p)
2	Mixer Bias V:	+0.000	+0.0102	0.000	Volts
3	Osc. Bisd V:	+0.000	+0.0102	0.000	Volts
4	Rx A Audio (W):	+0.000	+0.0246	0.000	V(p-p)
5	Rx A Audio (N):	+0.000	+0.0246	0.000	V(p-p)
6	Rx A DISC:	+10.427	-0.09274	0.000	kHz
7	Rx A S meter:	+0.000	+1.000	0.000	Counts
8	Rx E/F DISC:	+9.6234	-0.09911	0.000	kHz
9	Rx E/F S meter:	+0.000	+1.000	0.000	Counts
A	+5 Volt Bus:	+0.000	+0.0305	0.000	Volts
B	+5V Rx Current:	+0.000	+0.00010100	0.000	Amps
C	+2.5V VREF:	+0.000	+0.0108	0.000	Volts
D	8.5V BUS:	+0.000	+0.0391	0.000	Volts
E	IR Detector:	+0.000	+1.000	0.000	Counts
F	LO Monitor I:	+0.000	+0.000037	0.000	Amps
10	+10V Bus:	+0.000	+0.05075	0.000	Volts
11	GASFET Bias i:	+0.000	+0.000026	0.000	Amps
12	Ground REF:	+0.000	+0.0100	0.000	Volts
13	+Z Array V:	+0.000	+0.1023	0.000	Volts
14	Rx Temp:	+101.05	-0.6051	0.000	Deg. C
15	+X (RX) temp:	+101.05	-0.6051	0.000	Deg. C
16	Bat 1 V:	+1.7932	-0.0034084	0.000	Volts
17	Bat 2 V:	+1.7978	-0.0035316	0.000	Volts
18	Bat 3 V:	+1.8046	-0.0035723	0.000	Volts
19	Bat 4 V:	+1.7782	-0.0034590	0.000	Volts
1A	Bat 5 V:	+1.8410	-0.0038355	0.000	Volts
1B	Bat 6 V:	+1.8381	-0.0038450	0.000	Volts
1C	Bat 7 V:	+1.8568	-0.0037757	0.000	Volts
1D	Bat 8 V:	+1.7868	-0.0034068	0.000	Volts
1E	Array V:	+7.205	+0.07200	0.000	Volts
1F	+5V Bus:	+1.932	+0.0312	0.000	Volts
20	+8.5V Bus:	+5.265	+0.0173	0.000	Volts
21	+10V Bus:	+7.469	+0.021765	0.000	Volts
22	BCR Set Point:	-8.762	+1.1590	0.000	Counts
23	BCR Load Cur:	-0.0871	+0.00698	0.000	Amps
24	+8.5V Bus Cur:	-0.0092	+0.001899	0.000	Amps
25	+5V Bus Cur:	+0.00502	+0.00431	0.000	Amps
26	-X Array Cur:	-0.01075	+0.00215	0.000	Amps
27	+X Array Cur:	-0.01349	+0.00270	0.000	Amps
28	-Y Array Cur:	-0.01196	+0.00239	0.000	Amps
29	+Y Array Cur:	-0.01141	+0.00228	0.000	Amps
2A	-Z Array Cur:	-0.01653	+0.00245	0.000	Amps
2B	+Z Array Cur:	-0.01137	+0.00228	0.000	Amps
2C	Ext Power Cur:	-0.02000	+0.00250	0.000	Amps
2D	BCR Input Cur:	+0.06122	+0.00317	0.000	Amps
2E	BCR Output Cur:	-0.01724	+0.00345	0.000	Amps
2F	Bat 1 Temp:	+101.05	-0.6051	0.000	Deg. C
30	Bat 2 Temp:	+101.05	-0.6051	0.000	Deg. C
31	Baseplt Temp:	+101.05	-0.6051	0.000	Deg. C
32	FM TX#1 RF OUT:	+0.0256	-0.000884	+0.0000836	Watts
33	FM TX#2 RF OUT:	-0.0027	+0.001257	+0.0000730	Watts
34	PSK TX HPA Temp	+101.05	-0.6051	0.000	Deg. C
35	+Y Array Temp	+101.05	-0.6051	0.000	Deg. C
36	RC PSK HPA Temp	+101.05	-0.6051	0.000	Deg. C
37	RC PSK BP Temp:	+101.05	-0.6051	0.000	Deg. C
38	+Z Array Temp:	+101.05	-0.6051	0.000	Deg. C
39	S band TX Out:	-0.0451	+0.00403	0.000	Watts
3A	s band HPA Temp	+101.05	-0.6051	0.000	Deg. C

Figure 2. Original DOVE telemetry decoding parameters. (N4HY)

The LSTAT line is sent by the loader portion of PHT (the loader/command/telemetry task). Its purpose is to show the state of the loader process so that if something goes wrong during upload, we can tell what needs to be done to continue the process.

The LSTAT line comes In two types, as shown below.

I P:0xhhhh o:n l:nnnn f:nnnn, d:n st:n\

A: 0xhhhh, P:0xhhhh, o:n l:nnnn f:nnnn, d:n st:n "I" Means there is no software load in progress (inactive)

A: Means a software load is in progress (active). hhhh is the segment address of the program being loaded.

P: The segment of the running program (PHT). the initial load of PHT is always at 0x3000. any other address here means PHT has been reloaded.

o: the number of times the HDLC output queue was full when PHT tried to send a frame. this is left over from debugging the only major bug found in the I/O drivers since launch. A bug occasionally caused a 65535 byte frame to be sent, filling the output queue for nine minutes. This should always be zero.

l: the largest free memory block, In decimal paragraphs. To find the number of free bytes in the largest block, multiply this number by 16. This number shows the largest program that can be loaded at that time.

f: The total amount of free memory, in decimal paragraphs.

d: The digipeat flag, 1 is digipeat on, 0 is digipeat off.

st: The task number of the last task loaded.

Figure 3. LSTAT line decoding for DOVE. (NK6K)

Following is a breakdown of information in the STATUS line presently transmitted by DOVE. This only applies to DOVE and the current on-board software.

Counting from the left, the first pair of numbers being 0. All data is in hex.

0 - Receiver status. Bits 0 - 3 = Filter status of RX A-D: 0 = 1200, 1 = 4800. Bits 4 - 7 = gain settings of IR sensor. Normal = 8 = log mode. Normal for whole position is 80 = IR in log, filters in 1200.

NOTE: receivers in DOVE are for commanding only.

1 - Unused

2 - Unused

3 - BCR Set point. Is adjusted by housekeeping task software to provide best power transfer from panels to regulators. Normally 1E during eclipse and in the 80s in the sun. Roughly corresponds to telemetry channel 22h.

4 - Number of hours since last command. See 18.

5 - BCR status bits. Indicates status of various latches in the BCR used to gather telemetry.

6 - Transmitter power level, 0 to F. First number is TX1, second is TX2, although they will normally be the same.

7 - Which transmitter is in use. Bit 0 (LSB) Is TX1, bit 1 is TX2. A hex 02 indicates TX2 is in use, 01 would be TX1.

8 - Unused

9 - Status of switches in the voice/packet/s-band module (4). Will always be D0 in this version.

10 - Unused

11 - When WOD is in use, shows the number of samples taken/16. This provides a positive indication a collection has started, how far it has proceeded and when the sample bucket is full.

12 - Low end of nominal transmitter power range. See 13.

13 - High end of nominal transmitter power range. The housekeeping software moves the transmitter power between these two numbers to control the charge/discharge of the batteries, and keep the transmitter power as high as possible.

14 - Time between executions of the power control software in seconds.

15 - The transmitter power level that is set if the batteries get abnormally discharged. Normally 5.

16 - Count of errors on the s/c internal bus. This will increment on DOVE because module 4 no longer consistently responds.

17 - Overflow from 16.

18 - Days till the command timer will expire. Defaults to 2 on software start. Normally kept at F. This is another of the software "watchdogs" that attempt to assure the 2m transmitter doesn't get stuck on forever. If the s/c does not hear a command in this number of days, it jumps to the ROM boot loader firmware which turns all transmitters off.

19 - The module number the errors in 16 came from.

20 - Internal state related to transmitter lock-on avoidance. Normally 1.

Figure 4. STATUS line decoding for DOVE. (WDØE)

Ing programs is currently being offered as a "perk" for new members who join at the $30 yearly rate. They have other more sophisticated programs with many different features. Any of them, including the "perk," are good for finding DOVE.

Tuning for Doppler shift is easy. Since the DOVE output is FM on 2 meters, tuning is not always necessary. The maximum Doppler shift on an overhead pass is no more than +/- 3 kHz. At the beginning of a pass the signal will appear a few kHz high. At closest approach the signal will be on 145.825 MHz, and as the satellite heads away it will appear a few kHz low.

DOVE has two 2 meter transmitters. Transmitter two is more efficient and is usually on. It runs RHCP (right-hand circular polarization) with the satellite's antenna array while transmitter one creates an LHCP signal. A typical vertically-polarized home-station antenna does well with either transmitter. A small beam that can be rotated in both azimuth and elevation planes is desirable but not required.

For data capture and automatic decoding, AMSAT offers TLMDC-II at $20 for members and $30 for non-members at the number above or via mail at: AMSAT-NA, 850 Sligo Ave. #600, Silver Spring, MD 20910. Reception reports can be sent to: Dr. Junior Torres de Castro (PY2BJO), 119 Macaubal, Sao Paulo, BRAZIL 01254, South America. Special DOVE OSL cards will be sent to those submitting reception reports. Junior and BRAMSAT are particularly interested in hearing about equipment used and signal quality. While actual telemetry listings are not currently needed, they would also like to hear of any educationally-oriented activities using signals from DOVE.

Following are the formulas for calculating the output power of the DOVE transmitters from the value in STATUS line. It's necessary to calculate the power because the transmitter is off when the telemetry is gathered.

Transmitter number 1 (not in use at present)
Output power = s^2 X .020460 + s X -.027435

Transmitter number 2 (presently in use)
Output power = s^2 X .022176 + s X -.051588

Where "s" is one of the digits in STATUS line position 6 (counting from zero on the left). These will get you within a tenth of a watt or so at the high end.

Figure 5. Output power calculations for DOVE.

DOVE's Future

Even if the voice system is never fully exercised, many educational activities using DOVE are possible. Just a few of the studies conceivable include orbital mechanics, the speed of light and Doppler shift, thermal characteristics of the satellite, solar panel operation, satellite alignment with the earth's magnetic field, gravity and other general topics related to satellites and communications. If full voice operations become possible, many of the common telemetry outputs could be spoken rather than sent in hex code.

To amateur-radio operators, DOVE represents a very easy way to get started with hamsats. Most amateurs have some form of 2 meter equipment and can easily monitor DOVE's signal. The packet signals are easily captured by any packet system currently set up for terrestrial use. The 59 telemetry channels of data from this small cube in space offer information of interest to those engaged in satellite studies or just considering repeater telemetry systems or other remote-sensing experiments using ham radio.

When DOVE was brought back to 2 meter operation in November of last year, Junior PY2BJO offered his thanks to those involved In the satellite's recovery, "After a long time, DOVE is back again on 2m at 145.825 MHz. This project was created to provide an extremely simple way for those not familiar with satellite communications, especially those new to amateur radio, to take part in this exciting phase of our hobby. DOVE is finally beginning to live up to its original promise. After its rebirth, we at BRAMSAT are receiving many E-mail messages (PY2BJO@amsat.org) and letters. We are happy with this response, but we will be even happier when DOVE again becomes the popular satellite that we always knew it could be."

For further information on DOVE there are several publications covering the topic and other related satellites. All the books are available from AMSAT and include *Decoding Telemetry from the Amateur Satellites*, *The PACSAT Beginner's Guide*, *Proceedings of the AMSAT-NA Eleventh Space Symposium 1993* and *The Satellite Experimenter's Handbook*.

Number 15 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

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Last month I printed a few schemes used to mate the popular CP-1 interface, by AEA, with various computers. This month, with the help of F. A. Bartlett W6OWP of Paradise, California, let me share some more interfacing data.

Bart relates familiarity with AEA, Kantronics, and Microlog programs from the CP-1 era. While all three use the 5-conductor CP-1 cable and connect to the C-64 user port, each connects to different pins on that port. He is not aware of any programs for the C-64 that access the game port. CP-1 cables that terminate with a 9-pin joystick plug were normally intended to run with the C-64's baby brother computer, the VIC-20. While the CP-1 is the same for either computer, the cable used for the C-64 is the one that plugs into the user port. The pinout data for the CP-1 is as follows:

Pin 1—RTTY send/receive line from computer
Pin 2—RTTY input from computer
Pin 3—CW input from computer
Pin 4—Ground
Pin 5—CP-1 demodulator out to computer

Pin 5 is the left-hand pin, looking at the unit from the rear.

Referring to last month's diagrams, these would appear to be correct for AEA software, such as AEA MBATOR. Other software schemes hook up to different user port pins. See Table 1 for a comparison of several software connections.

As you can see, the software determines the use of each pin of the user port, so the connection to the CP-1 must be modified accordingly. If you are using some other form of software, with the data in the pinout chart you should be able to formulate a correct hookup if the software documentation does not give you the information.

My thanks to Bart for supplying much of this information. I am sure that many others will find it of use.

More Mail

Rick Newton KA3AUX of Pittsburgh, Pennsylvania, tells us that when he finds commercial RTTY stations on the air he is unable to copy them, even though he can tune in the signal. He wonders if they are using a speed that his C-64 cannot copy, or a code other than Baudot.

Well, Rick, as mentioned several times here in "RTTY Loop," commercial stations often run at speeds and with codes that "standard" RTTY programs cannot handle. Several of the newer programs around are able to digest these codes, though; and certainly multimode controllers, like those from AEA and Kantronics, handle them with ease.

To understand just what these stations are sending, there may be no better source than the Klingenfuss books mentioned a few months back. Just in case a new subscriber doesn't have the information, write to Jorge Klingenfuss at Klingenfuss Publications, Hagenloher Str. 14, D-72070 Tuebingen, Germany, for information on his extensive line of RTTY literature. And if you mention that you saw it in *73* magazine's "RTTY Loop," well, I have no idea what that will do for you, but it will make me happy!

While we're abroad, I'd like to acknowledge a note received from Jirka Hold OK1DR of the Czech Republic. He wrote that back when Czechoslovakia was still under Communist control, *73* magazine was illegally smuggled into the country for the benefit of that country's amateur radio operators. He was one of the first OKs to work with a Creed teleprinter, and eventually built a home-brew video terminal. His TU was also built from diagrams published in "RTTY Loop," many years ago. While the government interfered with operations during the 1980s, he is back on the air, and looks forward to giving an OK contact to his friends on RTTY in the States. George, I wish you all the best for success and continued solid operations!

"RTTY Loop" Software

Many of you have sent in requests for the "RTTY Loop" Software collection. Therefore, it gives me great pleasure to announce the fifth disk in the series. See Table 2 for programs contained on this disk, and brief descriptions.

As with the other collections, Disk #5 just about fills a 3.5", 1.44 Mb disk. So, for any or all of the "RTTY Loop" Software Collection, just send a blank disk (each collection fits on a 1.44 Mb disk), $2 in US funds per disk, and a self-addressed STAMPED mailer to return the package to you. Be sure to specify which disks you want, I am not clairvoyant! If you would like just a listing of what's available, send me a self-addressed, stamped envelope and I'll send you a printed list. That list is available on Email, as well. Now that America Online has an Internet gateway, you may reach me via Internet at MarcWA3AJR@aol.com, or on CompuServe at 75036,2501; or America Online at MarcWA3AJR; or Delphi at MarcWA3AJR.

I have some reviews in the works, and even a new online service, of interest to hams. Don't miss out, the next few months should be doozies!

CP-1 Pin	Kantronics HAMTEXT	AEA MBA-TOR	Microlog Airdisk
1	H	E	L
2	J	F	J
3	K	H	K
4	1 (one)	1 (one)	1 (one)
5	L	J	C

Table 1.

HAMC22.LZH	HamComm version 2.2 supports reception and transmission of amateur radio teletype (RTTY) and Morse code (CW) signals. A decoder for SHIP and SYNOP reports from weather stations is also included.
HFFAX5.ZIP	Receive HF WEFAX signals on your computer. Includes a simple hardware interface design.
JVFAX601.ZIP	JVFAX 6.0 is a multi-purpose program for the reception of both weather chart and photo style fax. For radio amateurs, there is an additional transmit option for fax and an SSTV transmit/receive facility.
JV_XMIT.GIF	GIF graphic of transmit adapter for sending SSTV with your computer and JVFAX program.
PACKPET.ZIP	PacketPeT Lite for Windows. Shareware version of commercial package, PacketPet for Windows, this is a Windows-based controller program for most hardware TNCs.
PACKY1.ZIP	Packy is a Windows program, designed for packet radio operation on ham radio frequencies using the AEA PK-232 or PK-88 controllers.
TOR32C.LZH	Run AMTOR on a PC with only a simple hardware interface.

Table 2.

Number 16 on your Feedback card

CARR'S CORNER

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A "Universal" VFO Project

Variable frequency oscillators (VFOs) can be used to control the operating frequency of receivers or transmitters, or as a signal generator for testing radio and electronic circuits, or for a large number of other applications. This month's column is dedicated to a small VFO project, built on a printed circuit board, that can be incorporated into any of several different projects that you might design.

The Circuit

Figure 1 shows the basic circuit for the VFO, except for the tuning circuits (which are shown in Figure 2). Transistor Q1 is a junction field-effect transistor (JFET) oscillator stage. The device to use at Q1 includes MPF-102, 2N4416 and the replacement devices from the popular lines of "service" parts (e.g. ECG and NTE). The NTE-452 and ECG-452 can replace the 2N4416, while the NTE-312 or ECG-312 can replace MPF-102 devices. The ECG and NTE devices can usually be bought through local electronic parts distributors who cater to the service and repair industry. Alternatively, NTE replacement semiconductors can be ordered from Ocean State Electronics [POB 1458, 6 Industrial Drive, Westerly RI 02891; 1-800-866-6626 (orders); 1-401-596-3080 (voice); 1-401-596-3590 (fax)].

The oscillator is followed by a two-stage buffer amplifier consisting of Q2 and Q3. The selections for Q2 are the same as for the oscillator. For Q3, use a 2N2222 or some similar NPN silicon device.

Two different oscillator configurations can be accommodated by this design (i.e. both Clapp and Colpitts oscillators can be built). Both oscillators are the same from point "A" in Figure 1 forward, and both depend on a capacitor voltage divider feedback network. The Clapp oscillator (Figure 2a) is series-tuned, while the Colpitts oscillator is parallel-tuned (Figure 2b).

The tuning circuits shown in Figure 2 consist of an inductor (L1) and several capacitors. One of the capacitors is the main tuning capacitor (Ctun), and another is a trimmer capacitor (Ct). Several fixed capacitors (Ca1-Ca3) can be used (optional) in order to craft an L-C tuned circuit with exactly the right capacitance and tuning range. It is not necessary to use any of these capacitors. You may also lump all of the fixed capacitance into a single capacitor, if desired.

The DC voltage supplied to the oscillator transistor (Q1) is voltage-regulated. The voltage regulator can be any 78Lxx series from 78L05 to 78L09. If the 78L05 is used, there may be some problems getting it to oscillate. I didn't experience any such problems in this particular case, but in other cases the lower voltages produced some problems. However, drift is typically lower when the lower voltages are used.

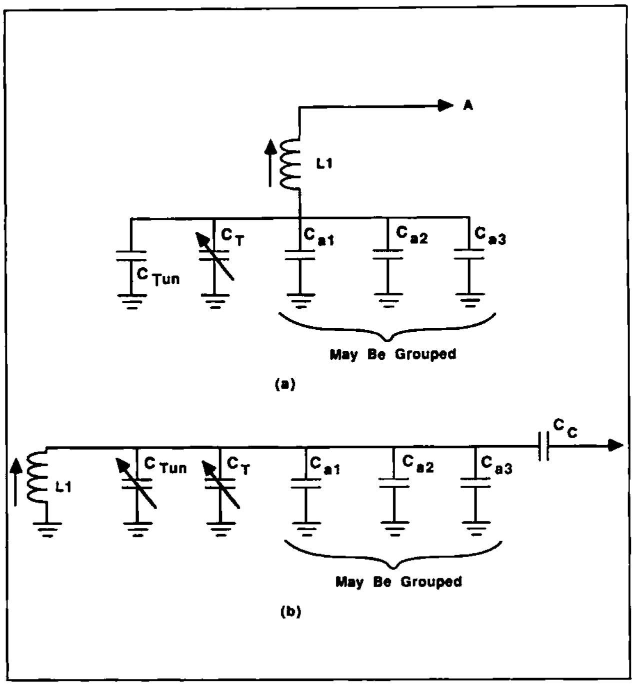

Figure 2. Tuning section of the VFO circuit: a) series-tuned Clapp; b) parallel-tuned Colpitts.

The values for the components can be developed from guidelines given by Doug DeMaw in *Solid-State Design for the Radio Amateur* (ARRL publication), p.34. As starting points (some experimentation may be needed) he recommends that L1 have a reactance of 140 ohms in the Colpitts case, and 260 ohms in the Clapp

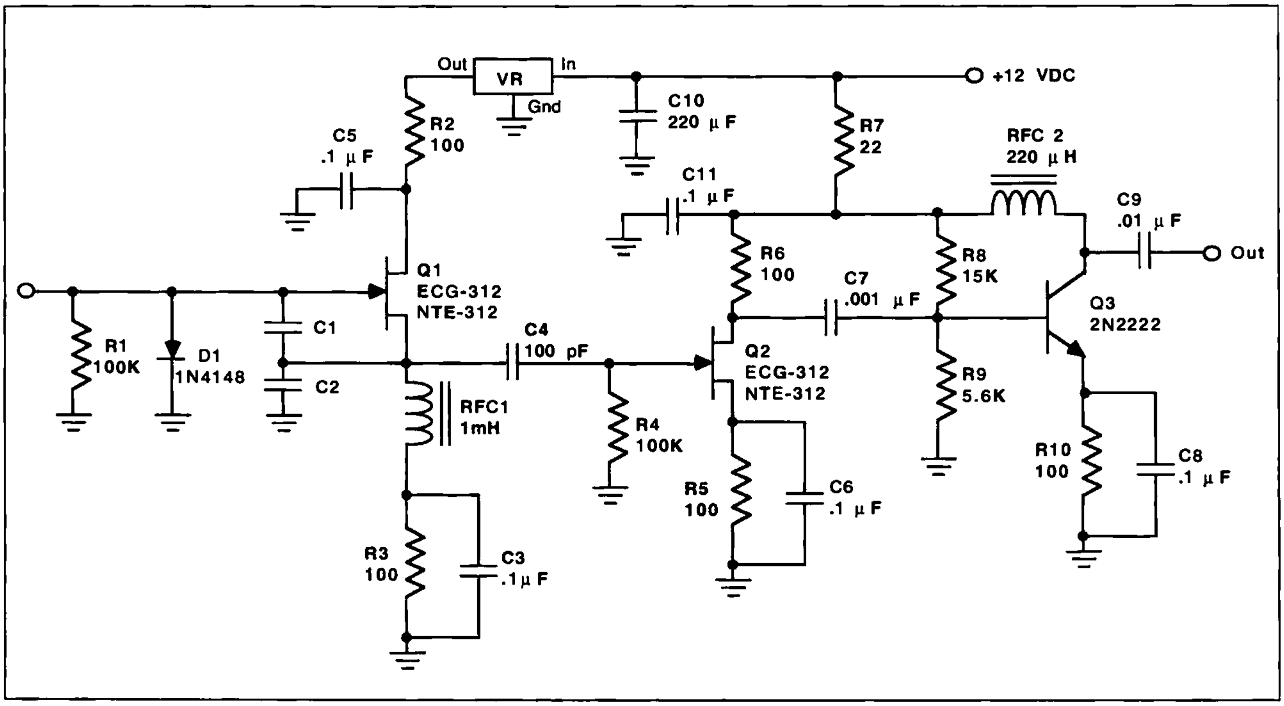

Figure 1. VFO circuit less the tuned circuits.

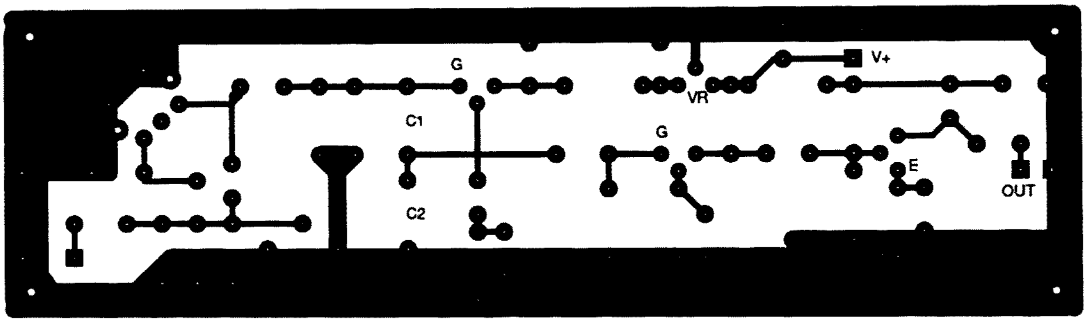

Figure 3. PC board foil pattern (1:1).

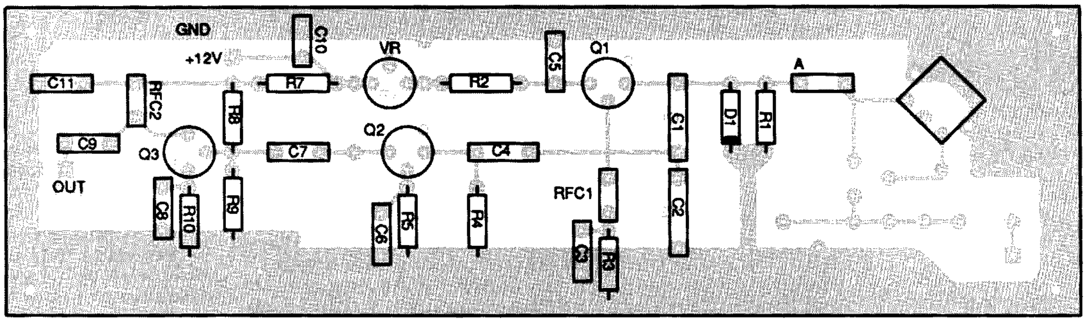

Figure 4. Parts placement for point "A" to the output.

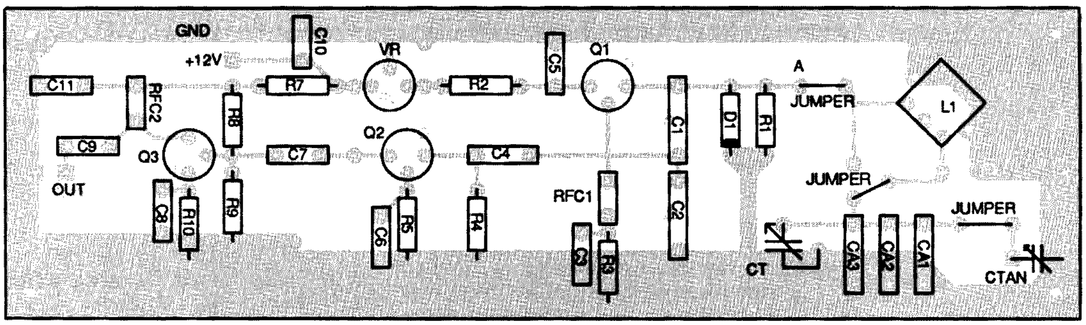

Figure 5. Parts placement with wiring for Clapp oscillator.

case. The total combination of all tuning capacitors should be about 200 ohms capacitive reactance, total. The feedback capacitors (C1 and C2) should have a reactance ot approximately 50 to 100 ohms.

If you select the feedback capacitors (C1 and C2) incorrectly, then you may find either of two situations. First, the oscillation will abruptly cease at one or both ends of the tuning range. Second, the amplitude of the output signal drops to zero as the main tuning capacitor is tuned towards the high end of the range. All oscillators vary amplitude somewhat as the circuit is tuned, but when C1 and C2 are incorrect, the effect often drops rapidly as the main capacitor is tuned . . . reaching zero at some point.

There are two RF chokes used in this circuit (RFC1 and RFC2). The values shown are nominal values for high frequency applications, but variation will generally not harm the circuit's performance.

Figure 3 shows the foil pattern for the printed circuit board used with this project. You can make your own if you please, or order one for $14 either from me (POB 1099, Falls Church VA 22041) or from FAR Circuits (18N640 Field Ct., Dundee IL 60118). The parts layout for the printed circuit board is shown in Figure 4 for point "A" to the output.

The printed circuit board is set up for certain standard components. For RFC1 and RFC2, select components with 0.2" (5 mm) spacing between pins, such as the Toko size 8RB or 10RB coils. See the Digi-Key (POB 677, Thief River Falls MN 56701-0677; 1-800-344-4539) catalog for details on specific part numbers. Main tuning inductor L1 is selected from the Toko 10EZ, 10EZC, 10EZH, 10PA, or 10K size slug-tuned coils (again, see the Digi-Key catalog for part numbers for desired inductances). The trimmer capacitor, Ct, should be a 10 mm top-adjust type, such as the Sprague-Goodman FILMTRIM series sold by Digi-Key.

Configuring the printed circuit board for either the Colpitts or the Clapp oscillator depends on how the tuning components are wired on the board. Figure 5 shows the wiring for a Clapp (series-tuned) oscillator. The tuning capacitor, the trimmer and the fixed capacitors, plus Inductor L1, are placed the same in both configurations. However, three jumpers are used in Figure 5 to make this circuit a Clapp oscillator.

Figure 6 shows the wiring for a Colpitts oscillator. One of the jumpers from Figure 5 is replaced with the DC blocking capacitor (Cc). The jumper from the fixed capacitors to the main tuning capacitor remains, and a new jumper is added from the bottom of L1 to ground.

Figure 7 shows the wiring for either Clapp or Colpitts cases where the tuning capacitor is series-connected with a small-value fixed capacitor. This configuration is often used for reducing the range of a variable capacitor to something required for a particular application. The total capacitance at any setting of the main tuning capacitor is:

$$C_{total} = \frac{(C_{BB})(C_{tun})}{C_{BB} + C_{tun}}$$

If you don't want to use the slug-tuned coil, but rather a toroid core inductor or air core inductor, then leave L1 off the board, and use the holes for the leads from the substitute coils.

Conclusion

This circuit makes a reasonable choice for many different VFO applications. It can be easily built, and is generally well behaved. Good luck.

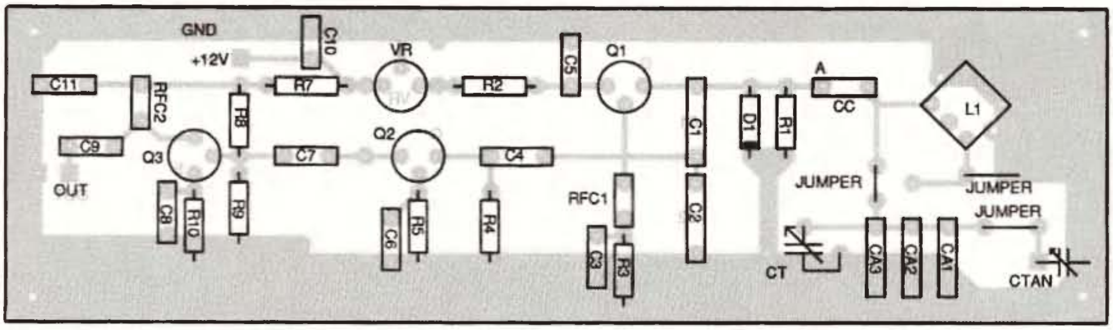

Figure 6. Parts placement with wiring for Colpitts oscillator.

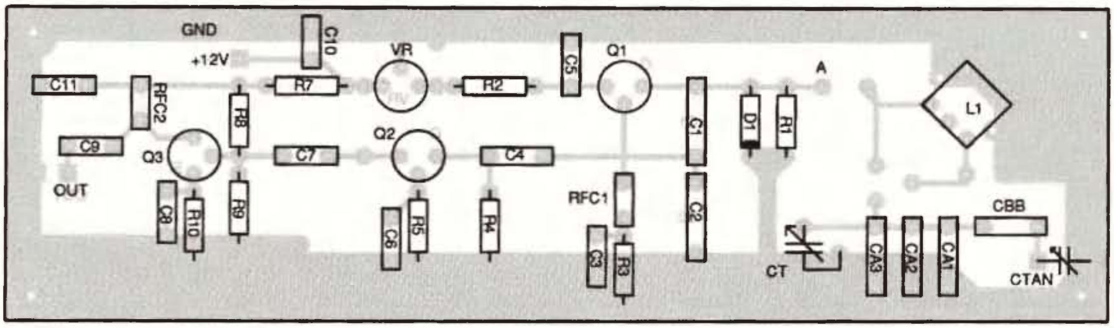

Figure 7. Parts placement with wiring for either Clapp or Colpitts cases where C_{tun} is in series with a fixed-value cap..

HOMING IN

Number 17 on your Feedback card

Radio Direction Finding

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Temblor Triggers a T-Hunt

Whether you want to play a musical instrument or pass a CW test, there is no substitute for diligent practice. The same goes for emergency preparedness. Both planning and simulated exercises are important for rapid, effective response.

After the January 17 earthquake in Southern California, ARES and RACES groups that had met regularly and held drills with their served agencies responded sooner and had greater overall success than groups that did not emphasize preplanning and operator training.

It takes practice to become skilled in radio direction finding (RDF) too. Hidden transmitter hunts (called fox-hunts and T-hunts) are more than just fun—they are practical lessons in signal propagation, antenna theory, and navigation. They can prepare you for rapid RDF response in a disaster or other emergency.

Un-Jamming the Sheriff

JaMi Smith KK6CU is a District Communications Officer for the Los Angeles Disaster Communications Service (DCS). Following the quake, he took charge of the RACES room at the Sheriff's Communications Center (SCC) and the county's Emergency Operations Center (EOC) in East Los Angeles. Thirteen hours after arriving, JaMi was taking a short break from his volunteer DCS duties when a county employee, also on break, mentioned that a steady carrier had appeared on a county-wide law enforcement frequency.

KK6CU loves to go T-hunting, especially with his motorized VHF quad and storage scope display unit (see "Homing In" for October and November 1992). But he had traveled by motorcycle to the EOC, leaving his gear at home in Pasadena. Besides, the stuck transmitter was near 482 MHz, out of range for his UHF RDF quad. Figuring that he could hunt the carrier with a beam and his extended-range handheld, he asked if a yagi for 482 MHz was available. The answer was negative.

Minutes later, JaMi was approached by Sargeant Larry Bryant N6LYA, Officer in Charge at County Incident Command, along with a sargeant from the Communications Section. They told him that the interference was blocking a sheriff's administrative repeater that was vital for radio assignment requests and earthquake-related mutual aid communications. Of 37 receiver sites in the county, eight were picking up the signal. Vehicles and RDF gear were available. Could he help?

JaMi and the communications sargeant surveyed the SCC equipment pool, finding three OAR Corporation RDF display units, each with antenna sets. Two had built-in receivers that did not cover 482 MHz. The last unit was a nearly-new OAR Model DF4003A. This model does not include a receiver. Further search yielded a Model 2002A multi-mode scanner made by AOR (not to be confused with OAR).

The DF4003A (Photo A) has two connectors for receiver IF, plus an audio connector. The scanner has no IF output connector. No equipment manuals were handy, so JaMi decided to try hooking just the scanner audio to the RDF set. For this, he needed a cable with an RCA plug on one end and a miniature phone plug on the other. He quickly made one by cannibalizing a set of headphones and soldering its cable to a spare cable with an RCA plug.

The sargeant offered a choice of vehicles and an officer to drive. He and the radio technician strapped the

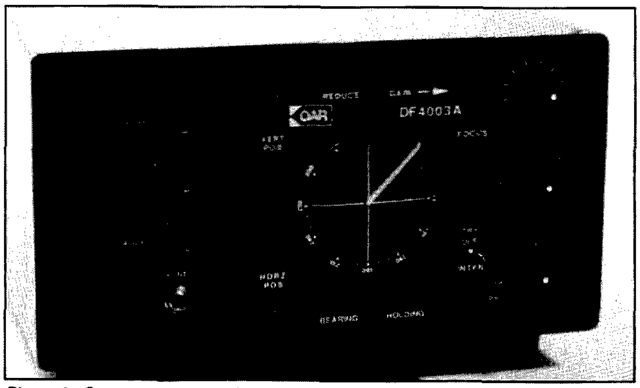

Photo A. Government agencies are the main customers for Watson-Watt RDF equipment from OAR Corporation. This Model DF4003A display unit works with external receivers and antenna sets covering 1 through 520 MHz.

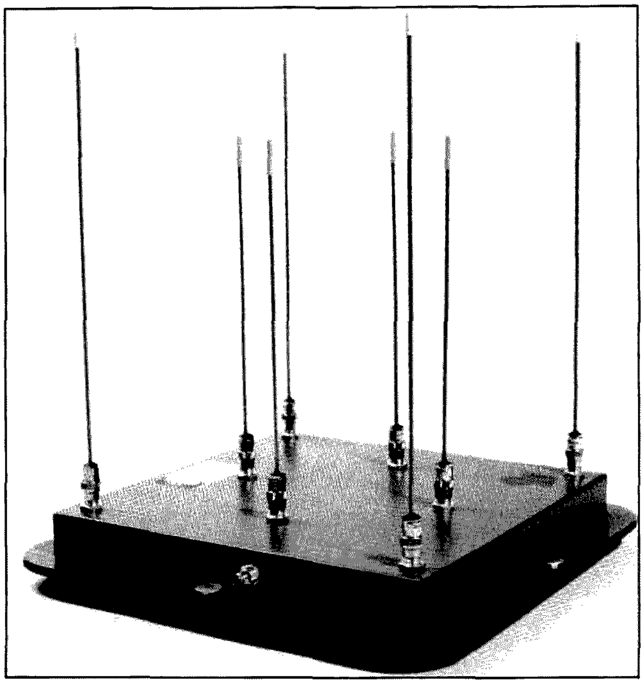

Photo B. It looks like a complex Doppler antenna, but the OAR Model MA350ED is actually two Watson-Watt arrays, a small one for UHF and a larger one for VHF

Model MA350ED RDF antenna (Photo B) to the car top and put the rest of the gear inside. After a quick check of the setup using a hand-held transceiver, they took off. JaMi rode with the driver in front; the technician sat in the back.

The offending carrier was not copyable at the SCC, but signal levels into the receiver "voting" system led the county's technician to conclude that it was coming from the north end of the San Fernando Valley, perhaps from Sylmar (see Figure 1).

Radio Waves and Ping-Pong Balls

UHF signals reflect from nearly any hard surface or object bigger than a breadbox. They carom off mountains, hills, buildings, billboards, and cars. The bearing on an RDF display tells the arrival direction of a signal, but in urban or hilly terrain this may not be the direction from which the signal originates.

When signals arrive at a receiver by both direct and reflected paths simultaneously, the effect is called "multipath." In severe multipath, an RDF

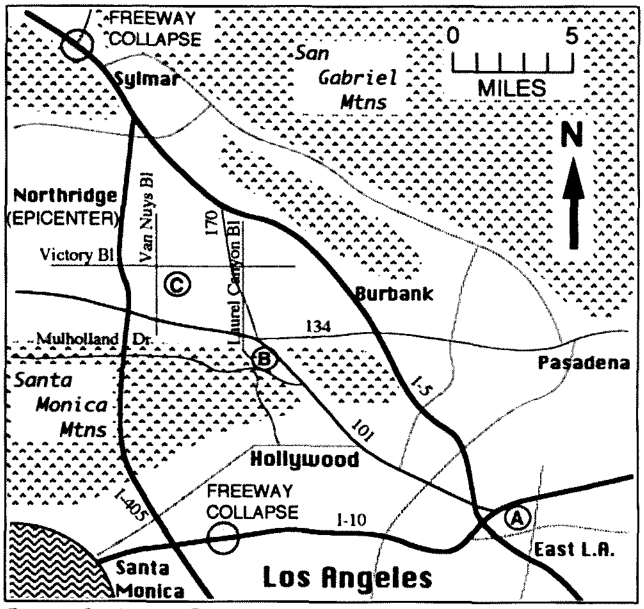

Figure 1. Starting from East Los Angeles (A), KK6CU went to the Hollywood hills for a clear bearing (B), then to the West Valley Administrative Center (C), where the stuck transmitter was found.

bearing may change constantly, or be consistently wrong. From his T-hunting experiences, KK6CU knew that the best way to maximize the signal level and get an accurate bearing, with minimum multipath effect, is to be as high and in the clear as possible. He decided to immediately go to the top of the hills above Hollywood.

"On Mulholland Drive," he says, "there's a great spot that overlooks the San Fernando Valley. I've used it on T-hunts before. We headed up Interstate 5, then west on Highway 134 to Highway 101. All we could get was an occasional blip of signal on the RDF set. We had just gotten off 101, going south on Laurel Canyon Boulevard, when I got a strong bearing to the west as we waited at the light.

"I suspected a reflection, and it went away as we went south. But as we gained elevation, the signal came up again, mostly bearing to the north, because it's a box canyon. The hills were to the east and west. Once we got up on Mulholland, there was a steady bearing and virtually full-quieting signal. Before, we had gotten a lot of broadband noise. I could tell that because I have learned from experience to check by tuning off frequency to see if I am hearing noise or signal.

"We had no map and no compass, but I knew that the streets in the valley run north and south, so I looked down there for reference. The strong bearing was about about 290 degrees true, pointing toward the extreme northwestern end of the valley. The tech said he didn't believe it. He still thought it was to the north."

Back at Highway 101, the trio headed west at well above the speed limit. "A couple of miles west, we started getting signal again," JaMi went on. "Then the bearing started to change. I got a couple of strong due-north blips at the Van Nuys exit, but we still guessed we would have to go to the far end of the valley. By the time we got to Interstate 405, we were not getting good signal strength because we were below ground level. We decided to go north on the 405, and as we came up, I got good bearings east of us, swinging again. I told the driver to take the next exit. He locked up the brakes, swerved over, and we went east on Victory Boulevard."

JaMi and his companions were now only six miles from the earthquake epicenter. Power was out in most places, and a curfew was in effect. Fortunately, the driver was an officer in uniform.

Multipath makes UHF RDF in urban areas tricky. Rows of buildings tend to "funnel" signals down the streets. The bearing may appear to be constantly in front (or behind), and then change suddenly at an intersection. "As we approached Van Nuys

Photo C. The Northwest District Superior Court building is famous for being the site of the recent Menendez murder trial. Now it has another distinction—the source of a signal that jammed sheriff's communications after the Northridge earthquake.

Boulevard, the bearing tended toward south," KK6CU continued. "Now the signal was full quieting and I could hear the DF tone plainly in the receiver audio.

"I had the driver pull out into the intersection very slowly. There was a lot of multipath and the display swung around quite a bit. I told him to continue east, and at the next street we went out in the middle again. It looked to be to the south, so we turned south for three blocks and found ourselves inside a large complex of government buildings, including two courthouses and the Los Angeles Police headquarters for the San Fernando Valley."

They headed for the police mobile command center, where JaMi got out and checked by the vehicles with his dual-band hand-held. No stuck mikes there. Back in the sheriff's car, they drove around the complex. Signal was weak everywhere except on the south side of the Superior Court building. They parked again and walked all

around, seeing no one but noting boarded-up doors and other signs of damage.

After walking back next door to the police station, they introduced themselves and KK6CU checked for signal inside the building. Meanwhile, the technician found out that a sheriff's radio set had been installed in the Superior Court building a year ago. Back they went to that courthouse (Photo C) to peer into the windows again.

"Finally, we saw somebody inside," says KK6CU. "It was a plainclothes deputy assigned to guard the building. He let us in and we asked directions to the communications room. There we found that the ceilings were wet and there was water all over the floor from leaking pipes. There was an old desk with stacks of paper around the edges of the desktop, which was sagging in middle. Water was a half inch deep in center, and an old desk mike sat in the middle of the pool, with the push-button switch submerged. I carefully pulled it out, shook it dry, and the carrier disappeared!

"We were still in a period of strong aftershocks, so we decided to get out of there right away. To be safe, we unplugged it and a few other pieces of equipment that were saturated. I disassembled the DF gear and we headed back to the SCC."

The submerged mike was connected to a 100-watt transmitter. So why was the signal so weak until the T-hunters were within a mile of the courthouse? It turned out that this radio is used mainly for communications within the building on simplex frequencies. The transmitter drives a long run of special "leaky" coax that goes up the south side of the building to a dummy load. Enough signal escapes from the coax to reach the officer's transceivers inside for simplex work. The signal can also be heard by the sensitive sheriff's repeater network when the transceiver is switched to the administrative frequency, which the marshal had apparently done at the end of the last work shift before the quake.

Despite unfamiliar equipment and a weak signal, KK6CU and his helpers found the problem and fixed it in less than an hour. Without JaMi's understanding of RDF principles and his practical foxhunting experience, it would have taken much longer.

Introducing the Watson-Watt

OAR (which stands for Ocean Applied Research) is a well-known name among commercial and government users of RDF equipment. T-hunting hams seldom buy OAR gear, due to its cost. Sticker price of the DF4003A plus a basic antenna system covering 2 meters (MA350) is $11,700.

Why so much? After all, you can buy an excellent commercial Doppler RDF unit with digital readout and 2 meter mobile antenna set for about $850. You can build the popular and effective Roanoke Doppler from scratch for much less. The reason for the price difference is that OAR units do not employ the Doppler principle, even though they have four vertical whips and put a tone in the receiver audio, just like a Doppler set does.

OAR sets use the Watson-Watt RDF scheme, which is derived from the Adcock, one of the earliest RDF antennas. Whereas a Doppler rapidly selects one of the four (or more) whips at a time in sequence to give an electronic rotation to the array, a Watson-Watt uses the four antennas as two orthogonal pairs, combining signals from them in three distinct modes. Processing these modes produces a vector on the cathode-ray tube display. The vector position tells direction of the incoming signal. Vector length indicates signal strength and quality, helping the operator detect and combat the effects of multipath.

One reason for the high cost of OAR gear is its special three-channel processing, which makes one receiver do the work of three. Some OAR models include a built-in receiver, while others work with an external receiver or scanner. Unlike the Doppler, which uses ordinary narrowband FM receivers, the Watson-Watt signal processor requires AM detection. Direct connection of the processor to the receiver IF stage allows normal use of the receiver for monitoring in any mode. If the receiver does not have an IF tap, the OAR DF4003A can be hooked to receiver audio output, but the set must be kept in the AM mode.

There is no RF switching in the Watson-Watt antenna array, which can result in better system sensitivity than Doppler installations. OAR sets include a track-and-hold feature for capturing very short signal bursts, and integration of bearings over time to average out multipath effects while in motion. Doppler sets are usually limited to tracking carrier-type signals such as FM and CW, whereas the Watson-Watt method tracks all these plus SSB and pulsed noise sources.

For More Information . . .

OAR's manufacturing facilities are in San Diego, California, but the primary sales office is on the East Coast: OAR Corporation, 2165 Druid Park Drive, Baltimore MD 21211; (410) 462-1700.

Plans for the Roanoke Doppler are in the book *Transmitter Hunting—Radio Direction Finding Simplified*, available from your local bookstore. This book also includes a comprehensive discussion of both Doppler and Watson-Watt RDF techniques.

HAMS WITH CLASS

Number 18 on your Feedback card

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Self-Esteem: The Key to Success in School and in Life

With parent-teacher conferences scheduled to take place at my school this month, I thought about all the things I wanted to convey to the parents of my new sixth-, seventh-, and eighth-grade ham radio students. I made a package of brochures ot inexpensive rigs and radio accessories that I could show them. Besides sharing individual students' progress with each parent. I planned to give my usual "propaganda" speech for ham radio. This was quite ambitious for what was supposed to be a two-minute conference with a parent.

I thought back to how much the children in my classes have changed over the last 10 years. As the largest intermediate school in Staten Island, New York, we have seen a huge change in the population of our students. We presently have over 80 different languages and dialects represented; creating a need for a full-time ESL (English as a Second Language) teacher. Many of our students come from low socio-economic backgrounds, bringing with them a whole different set of problems which could interfere with the learning process.

The problems facing teachers in inner-city schools today are varied and complex. They cannot be ignored for they will surely not go away by themselves. The one common thread that seems to run true year after year of dealing with this difficult age group is that they all respond to respect and genuine caring. I filed my radio brochures away and dug out some articles I had saved to read that were published by The National PTA. I found the one I wanted, and proceeded to run off 100 copies of it. I plan to share it with my colleagues and to distribute it to the parents who come to see me to discuss their child's progress.

Without helping children to develop self-esteem, we will inevitably fail at whatever other good things we try to teach them. As a parent and as a teacher I encourage you to include the following in your repertoire of important things to teach your children, along with rules of radio procedure and Ohm's Law, etc.

Studies have shown that helping children develop good self-esteem is probably the most important thing parents and teachers can do for their children. Critical decisions, such as whether or not to use drugs, or to stay in school or drop out, are affected by their sense of self-worth—their self-esteem.

15 Ways to Help Children Like Themselves

1. Reward children. Give praise, recognition, a special privilege, or increased responsibility for a job well done. Emphasize the good things they do, not the bad.
2. Take their ideas, emotions, and feelings seriously.
3. Define limits and rules clearly, and enforce them. Be consistent.
4. Be a good role model. Let them see that you, too, can make mistakes and can learn from them.
5. Teach children how to deal with time and money.
6. Have reasonable expectations for your children and your students. Help them set realistic goals so they can experience success.
7. Help children develop tolerance toward those with different values and backgrounds. Point out other people's strengths.
8. Give children responsibility. They will feel useful and valued.
9. Be reasonable. Give support when children need it.
10. Show them that what they do is important to you. Talk with them about their activities and interests. In the case of radio students, ask them to tell you what they enjoy most about the hobby.
11. Express your values. Describe experiences that determined your values, and the reasons behind your beliefs.
12. Spend time together. Share favorite activities. Ham radio is great for this.
13. Discuss problems without placing blame or commenting on the child's character. If children know there is a problem but don't feel attacked they are more likely to look for a solution.
14. Use phrases that build self-esteem, such as, "That was an excellent idea." Avoid phrases that destroy self-esteem, like "How many times have I told you?"
15. Show how much you care about them. Tell them you think they are terrific. Use body language, smiles, and words that make children feel good to let them know that you are interested in them as people and that you have something really special to share with them. Many youngsters have told me that they originally got their radio licenses because they wanted to make me proud of them.

As responsible adults working with children, we owe it to them, and to each other, to make every child feel special and worthy so that they can become happy, productive members of society.

Be sure to stop by at the Dayton Hamvention Youth Forum on Saturday, April 30th, to lend your support to all the youngsters who will be speaking there. We've got a terrific group of children lined up.

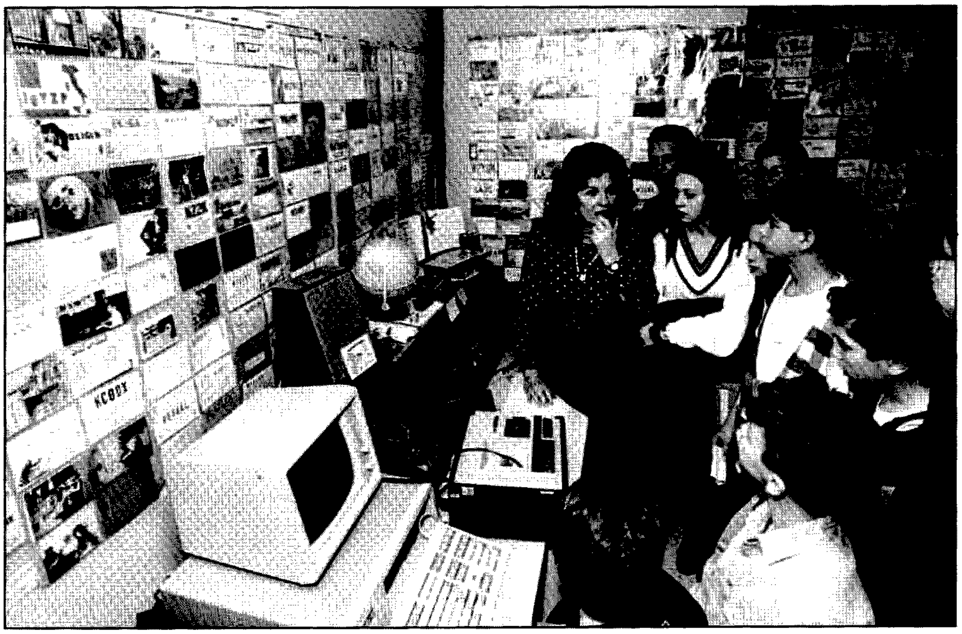

Photo A. Ham radio provides a great opportunity to share interests and activities.

QRP

Number 19 on your Feedback card

Low Power Operation

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Have you been looking for a good analog meter for a project? Have you found out how much they cost? One would think, with the entire world going digital, analog meters would be really, really cheap. The exact opposite has occurred instead. Now, a quality analog meter costs more than the project you're trying to construct. You can still find plenty of surplus analog meters laying around however, provided you don't mind the face printed with some strange industrial scale.

Entering the Digital World

This is a case of "if you can't beat 'em, join 'em" as digital panel modules are now available at a very reasonable price. I've have been working with two different models from two different suppliers.

They're both low power 3-1/2 digit LCD digital panel meters. Their basic input requirement is 200 mV DC. Other input ranges are also possible, by special order. The first module we'll look at is the D1 International DPM5035L. The second module is by Modutec.

Specifications

The DPM5035L is built around a Maxim MAX131CPL analog-to-digital converter chip. Along with some support parts, the Maxim chip does all the work. The LCD Is an easy-to-read 0.5" high and shows 3-1/2 digits. Automatic zero and a polarity indicator are part of the DPM5035L. You can select your own decimal point position. A "1" displayed on the left-most side of the DPM5035L is the over-range indication. The conversion rate is about three times per second.

The DPM5035L has a basic DC input of 200 mV. The input is differential. Input impedance is over 11 megohms. You can operate the DPM5035L on a single 9 volt battery. Any power supply from 5 to 9 volts will work just fine. The low battery indication comes on at approximately 4.8 volts. According to the factory, a fresh 9 volt battery should operate the DPM5035L for over one year. If you want, or if you just don't need the LCD display, you can also order the DPM5035L in an LED-readout version. Its number is DPM5135. This LED version requires 5 volts at less than 130 mA. This would be an ideal DPM for a power supply. Both the DPM5035L and the DPM5135 are available from D1 International Inc., 95 East Main Street., Huntington NY 11743; (516) 673-6866. The price for the DPM5035L is about $30, plus shipping.

The Modutec digital panel meter is so very close to these specifications I won't repeat them. The Modutec DPM I used is the BL100101. You can get this meter from Digi-Key for $33. While it has the same LCD, 0.5", and displays 3-1/2 digits, the Modutec DPM is much smaller than the DPM5035L. In fact, you can place the Modutec DPM inside the D1 International DPM.

Differences Between the Two

Both of these DPMs are very much alike electrically; the main difference is in their physical layout. The DPM5035L is the larger of the two and requires much more panel area than the Modutec DPM. This may be of concern if you're wondering about using one of these DPMs in your next QRP project. Although larger, the DPM5035L is much easier to install. The DPM5035L snaps into the panel cutout. No other hardware is required. This bezel allows for some "operator error" when cutting out the panel. The Modutec DPM, on the other hand, requires a very clean-fitting cutout. There is no bezel to hide your mistakes. The Modutec meter also requires you to add a mounting clip and plastic nuts. It's no biggie, but you have to really take your time to do the installation properly with the Modutec DPM. The Modutec meter also requires a connection kit. This kit is a header on 0.100 centers. The input to the Modutec meter is very sensitive to static discharges and you are warned not to solder directly to the DPM pins. Use the connection kit to avoid problems.

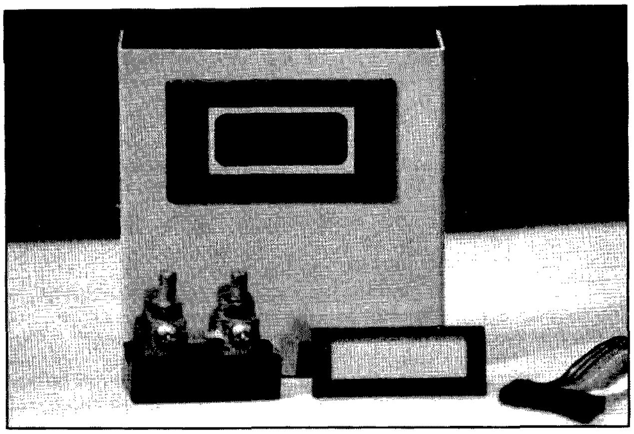

Photo A. The D1 Digital Panel Module mounted in a case. The Modutec meter is in the foreground with its connector. A 100 amp 100 mV shunt is also shown.

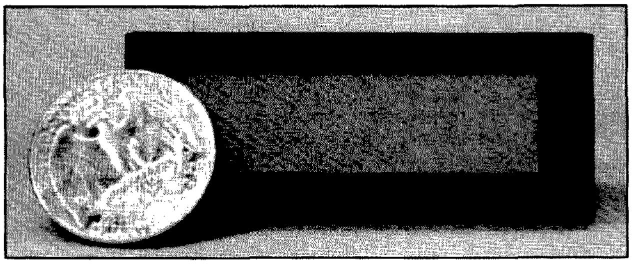

Photo B. The Modutec Digital Panel Module is tiny.

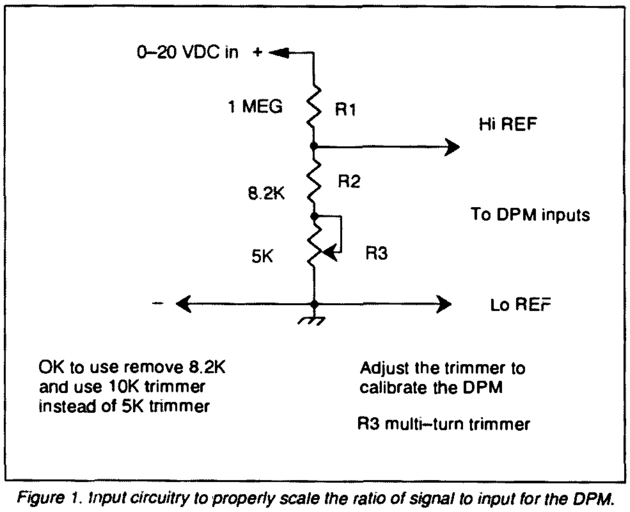

Figure 1. Input circuitry to properly scale the ratio of signal to input for the DPM.

Making Them Work

A very popular use of the DPM is to measure voltage from a power supply or a battery. The first step you need to do is scale the input so the DPM knows what to do with it. With an input of only 200 mV, it becomes quite clear you must keep the proper ratio of signal to input. Take a look at Figure 1. You'll notice that the two resistors scale the input from our power supply down to a value the DPM needs. We have scaled the 200 mV input to 20 volts input. In case you don't have 1% resistors on hand, I added the 10k trimmer to fine-tune the voltage divider. An 8.2k and a 5k trimmer provide an easier adjusting of the DPM.

By changing the values in the voltage divider, while keeping the ratio the same, you can scale the input to just about any value you require. The only precaution would be to increase the number of resistors in series when measuring very high voltages. This would prevent flash over of a single resistor. Of course, you QRPers don't need to worry about measuring kV in our amplifiers—unless you happen to smoke cigars!

Trouble with the Input

If you look close at Figure 1, you'll see there is a second power supply running the DPM. That's because you can't have the Lo REF tied to ground. This causes the A-to-D converter chip inside the DPM to become confused and display a false reading. There is only one way around this problem. You must have a separate power source to operate the DPM. Luckily for us, we have three choices. The first is to use a 9 volt battery. It's simple, cheap, and sure is easy. The second is to operate the DPM from a separate power source such as a wall wart power supply. Or, we can use a DC-to-DC converter.

You can buy commercial DC-to-DC converters just about anywhere. But, hold onto your hats, they're not cheap! The one D1 International sells to operate their DPM runs about $20. It generates a +9 volt supply which is totally isolated. I've seen DC-to-DC

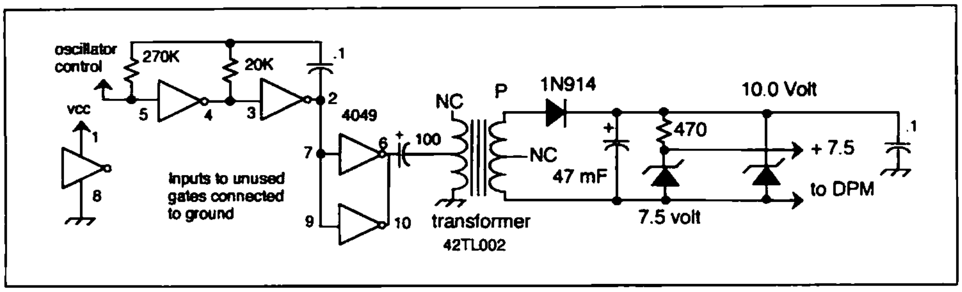

Figure 2. DC to DC converter for the DPM.

converters listed in surplus catalogs. One had a converter that would fill the requirements for under two bucks. It is important when shopping for a converter to get one that supplies an isolated +9 (or +5) volts. Some voltage converters generate a different voltage than the supply. This is not what you want for the DPM.

You can roll your own DC-to-DC converter without too much trouble. In fact, all you need is just a spoonful of parts. Figure 2 shows the DC-to-DC converter I built up using some junk box parts. The output from the oscillator is coupled to a small transformer. The output is then rectified, filtered and regulated to 7.5 volts with a zener diode and a resistor. A second zener diode is also across the output of the converter. This diode acts as a safety valve in case the 7.5 volt zener opens up. If that happens, the 10 volt zener will short the output together, protecting the DPM from overvoltage. In my DC-to-DC converter there is very little current developed. Although I've never measured it, I would guess the total amount of current generated would be less than 10 mA.

Just about any type of oscillator can be used in this circuit. I've used a single gate of an LM324, a 555 timer, a 4049, and at least several others, too. In fact, nothing is really critical. The driver transformer is available from Mouser Electronics.

Notice how the output is separated from the supply ground. This gives us the required isolation. The 0.1 µF capacitor from the output to system ground was required to keep a nasty spike from confusing the DPM.

I built this converter on a hunk of pert board. There is no PC board layout for it. Since the converter uses an oscillator, it may be possible to hear this oscillator in your receiver. Some careful shielding of the converter will keep all the noise inside and out of the receiver.

If you suffer from inductorphopia, you might be able to come up with a suitable DC-to-DC converter without the transformer. Perhaps some types of capacitance-coupled diodes may work.

Measuring Current with the DPM

There is one more task the DPM is capable of doing: It has the ability to measure current. All you need is a shunt in the negative lead and you're ready to go. If you use a calibrated shunt the display will be accurate; if you use a homemade shunt you'll need to calibrate the meter.

A laser trimmer 100 mV shunt is what I use. This shunt will drop one millivolt for every amp of current. So, at 100 amps, we have 100 mV across the shunt. If this is applied to the DPM, the display will be 100. You can select the display decimal point by using a switch. At 10 amps, the display would read 010 and so on. It is important that the shunt be in the negative lead. And again, the DPM must be running on either a battery or the DC-to-DC converter described above. I have a source of laser trimmer 100 mV shunts. They're not cheap, about $35 each, but if you're interested, drop me a note.

Depending on the amount of current you want to measure, you can build your own shunt. A six-inch piece of solid #14 copper wire wound on an AA battery works great. Use the battery as a form only; remove it before you use the shunt. You have to calibrate this shunt with a 100k-to-470k trimmer as shown in the schematic. Either value will work. To calibrate the shunt, first connect a load of several amps in series with a source of power and the shunt. A headlight makes a cheap and dirty load. Now install your own current meter, say your multimeter, in series, too. Turn on the supply and note the current on your multimeter. Adjust the trimmer so the DPM displays the same value. Place a drop of paint or nail polish on the trimmer to prevent its movement and you're all done. By using a shunt and the DPM, you have a great way to measure a large amount of current safely. A multi-pole switch would be ideal for a combination voltage and current display.

Other Uses

Although the DPM is really at home with current and voltage, it can be made to do other tasks. If you want to display frequency, for example, all you have to do is add a frequency to voltage chip and display the results on the DPM. Measuring SWR or RF power would be easier yet. Two of the DPMs, one to measure forward power and a second to measure reflected power, would be easy to build. In fact, the Kanga power bridge would be a good test bed for a project like this. Right now, I'm working on my own version of a field-strength meter using the DPM from D1 International. Should be an interesting project to build.

Field Day

Next month is Field Day, a traditional outing for QRP stations. How about getting those Field Day photos together and sending some in? Other QPRers would like to see what the guy's station looks like after the smoke clears.

While life may be too short for QRP, intense levels of RF and those cigars will do you in quicker!

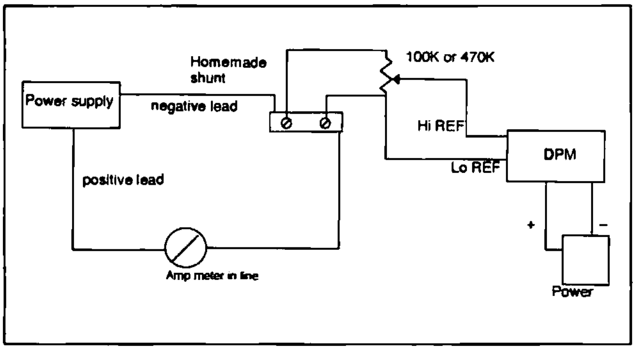

Figure 3. Using a power supply to calibrate the DPM to read current.

Number 20 on your Feedback card

PACKET & COMPUTERS

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Getting Started in TCP/IP, Part 7

From Here to There—Routing and TCP/IP

This month's installation of our TCP/IP series will concentrate on routing, the specification of the path that traffic should take between stations.

If I want to connect to your station, but cannot hear it directly, I am not out of luck. The TCP/IP protocol offers the ability to create "routing tables" which specify how traffic addressed to a particular station should be directed. TCP/IP uses what is called "static routing," that is, it depends upon the tables you create to find the intended station for a given address.

ARP

ARP means Address Resolution Protocol, and this is the TCP/IP service that lets JNOS figure out what you mean when you save N1EWO.AMPR.ORG. Let's follow a hypothetical connection by you to my station. We'll use the ttylink (chat) program so we can talk. The first step is for you to type the proper command at the prompt:

```
59872 net>tty N1EWO
```

This tells JNOS to make a telnet connection to port 87 of my station—which is the ttylink service. The first thing your station does is make an ARP request on the air. Il we switch to the monitor screen (by pressing F9) we see:

```
AX25: (your call) ->QST
      UI pid=ARP
ARP:  len 30 hwtype AX.25 prot
      IP op REQUEST
sender IPaddr 44.(your IP
address) hwaddr (your call)
target IPaddr 44.48.70.22 hwaddr
```

Your station is asking the world, "What is the hardware address of 44.48.70.22?" What is a hardware ad-

> ***"This month's installation of our TCP/IP series will concentrate on routing, the specification of the path that traffic should take between stations."***

dress? TCP/IP is network layer protocol, and in the ham radio world it runs over an AX.25 (plain old packet) link. We use the AX.25 link to create the connection between stations—we use TCP/IP to manage and control data between stations. So, the hardware address is whatever "mycall" is set to for a TCP/IP station. The purpose of the ARP request is to find out what that call is, so communication can take place. TCP/IP is a "datagram" protocol. This is in contrast to a "virtual circuit" protocol such as AX.25. In other words, data transfer via TCP/IP on ham radio is accomplished with AX.25 UI (Unnumbered Information) frames—in plain language, the stations never connect in the AX.25 sense.

By way of example, if we were using NOS over an Ethernet network instead of AX.25, the hardware address that would be sought by the ARP request is the MAC (Media Access Control) address. This is an eight-byte address that is unique to an Ethernet NIC (Network Interface Card), just as "mycall" is unique to an AX.25 station.

Let's assume that my station can hear your station directly. I hear your ARP request and reply (again in the monitor screen):

```
AX25:   N1EWO -> (your call)
        UI pid=ARP
ARP:    len 30 hwtype AX.25
        prot IP op REPLY
sender IPaddr 44.48.70.22
hwaddr N1EWO
target IPaddr (your IP
address) hwaddr (your call)
```

As you can see, my station sent a REPLY to yours indicating that my hardware address is N1EWO. It could have been N1EWO-1 or some other SSID (Secondary Station IDentifier, the -1 part). Or, what if I couldn't hear your station—is all lost?

No, there are at least a couple of ways around that. First, I could fix things from my end by arranging a "gateway" and having it "publish" itself as the hardware address to reach me. To make this work takes two steps. First I must use the ARP command (at the gateway station) to publish itself as the hardware address for my station:

arp publish 44.48.70.22 ax25
(gateway hwaddr) (interface)

where:

44.48.709.22 is my address
ax25 is the hardware type
(gateway hwaddr) is the call of the gateway
(interface) is the name of the interface on the gateway that will publish this address.

Now an ARP request for my hardware address will be answered by this gateway station. Trouble is, if I do nothing else this doesn't let us communicate. I need to tell the gateway where to send the traffic that it gets for me. I do this with the ROUTE command:

route add 44.48.70.22 (interface)

Now traffic sent to this station will be sent out the interface specified.

Alternatively, you can set it up from your side. This works by manually adding my station to your ARP list:

arp add 44.48.70.22 ax25 N1EWO
(interface)

which puts a permanent entry in the ARP table for me. The second step in this process is to add an AX.25 route to my hardware address using the ax25 command:

ax25 route add N1EWO (interface)
(digis . . .)

This puts an entry into the AX.25 routing table for my hardware address, letting you connect. The ARP entry means that you don't have to send out a request—which I could not hear. You can see that TCP/IP routing is "static"—you set it up and then must change it manually. If you can hear the stations directly, it is dynamic (you ask, it tells, your tables are built), but not otherwise.

Next month we'll look more at routing. 73 de N1EWO.

ATV

Number 21 on your Feedback card

Ham Television

Bill Brown WB8ELK
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ATV Birthday Party

Kim Cohan KD6TLB wanted his 30th birthday party to be unusual and unique. Since he is a pilot and also loves ATV, he decided to combine these interests and throw a truly amazing aerial celebration that the locals would keep talking about.

After a lot of coordinating with the FAA and local airport officials he was able to arrange to have four skydiving instructors from the Hollister airport parachute from an altitude of 11,000 feet to land right in his back yard (fortunately he lives right next to the Carmel Valley Airport). To make this a truly memorable experience, he enlisted the aid of some of the members of the Naval Postgraduate School ARC in Monterey to work out a way of televising the jump live via ATV.

Skydiving TV

Doug McKinney KC3RL designed a small knapsack 1 watt ATV transmitter that strapped around the waist of the skydiver. The transmitter consisted of a Kreepie-Peepie transmitter (P.C. Electronics), an audio ID that sent out a CW message over the ATV audio subcarrier and an eight-cell AA alkaline battery pack mounted in a sturdy metal enclosure (Bud CU-247 or Hammond 1590D). Doug found that by using an alkaline AA pack he could keep everything lightweight and compact and still operate the system for around four hours. One unique feature that Doug designed into his ATV box was a latching ON/OFF toggle switch. Once turned on, you need to lift up the toggle and physically slide it over to allow it to snap off. It is virtually impossible to accidentally brush against this switch and move it. Anyone building up a portable ATV system may want to incorporate this switch into their design. It is available from Digi-Key (part number CKN1015-ND) and is made by C&K Company (called the K-locking lever).

Photo A. Skydiver Jess Rodriguez demonstrates his unique helmet camera system complete with ATV transmitter. An 8mm camcorder and a 35mm film camera is mounted to his helmet via an aluminum bracket. The ATV transmitter is strapped to his waist inside of the knapsack and the ATV antenna can be seen attached to his shoe.

Finding a good place to attach the antenna to the skydiver presented an interesting problem for Doug. He tried taping a 440 MHz rubber duck antenna to the skydiver's shoe but found that this caused problems due to detuning. To solve this problem, Doug formed a 2"-thick urethane spacer out of "Great Stuff" spray foam (found at most hardware stores). He mounted the rubber duck on top of the foam and carved out the bottom of the foam so that it rested on top of the skydiver's shoe. RG-58 coax was run from the transmitter down to the antenna underneath the skydiver's flight suit (it's important to keep cables from tangling up with the other skydivers in the plane prior to jumping). This arrangement allowed the skydiver complete freedom of movement without the danger of tripping over cables or the antenna during landing.

The Skycam Helmet

It turned out that Jess Rodriguez, the skydiver chosen to carry the ATV system, had already developed his own system for videotaping his flights (see Photo A). He had an 8mm camcorder strapped the top of his helmet and a mechanical sight that he could place in front of one of his eyes. All he had to do was to line up the sight with whatever scene he wanted to videotape (important for filming formation skydiving). Interfacing the camcorder to the waist-mount ATV transmitter simply involved running a small cable behind the helmet and under his jacket.

Taking a Fall

To receive the signal, Mike Marchini WA6EOC, Pat Carter KA6IRS, Steve Bible N6HPR and Don Nichols KB6BZL set up a ground station under a tent on the edge of the Carmel Valley airport. Mike and Pat also recorded the flight on their VCR. We all crowded out onto the airport and could just make out a tiny speck moving across the sky. Using a six-element beam we started to receive an excellent ATV picture showing the inside of the jump plane as it circled overhead at 11,000 feet. Soon we could see several small dots as the skydivers jumped out of the plane. Everyone crowded around the TV set, and all were amazed to see a beautiful image of the skydivers linking hands and free-falling in formation. The helmet camera provided a very stable image that gave us the illusion that we were up there free-falling with them. One by one they opened their steerable parafoils and treated us all with an aerial tour of the Carmel Valley as they gently descended towards the airport. As the skydivers landed in front of us, each shouted out "Happy Birthday" to Kim, folded up the chute, and joined the party.

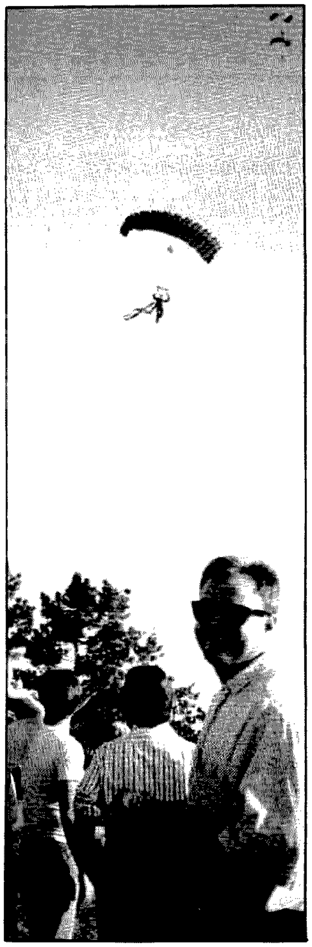

Photo B. The birthday guy, Kim Cohan KD6TLB, looks on as Jess Rodriguez and his Skydive Cam prepare to land at the party.

The Ultimate Birthday Balloon

As if skydiving ATV wasn't enough, we launched an ATV balloon (with color camera) about an hour after the skydiving adventure. This package contained a lightweight color TV camera (Howard Associates, Thousand Oaks, CA), a 5 watt ATV transmitter on 434 MHz (micro-ATV transmitter with a P.C. Electronics PA-5 power brick) and a GPS system on 2 meter packet built by Doug McKinney KC3RL. We launched this package just a couple of hours before sunset and treated the party-goers with an aerial view of the mountains as the balloon drifted up into the stratosphere. The chase crew was deployed near the impact zone (about 50 miles southeast of the party) but darkness and the remote landing site prevented a recovery that night. Thanks to Kim's eagle eyes, he spotted the payload a few days later while flying over a ranch in the foothills east of King City in his Cessna 150. After fending our way past a few herds of cattle we were able to recover everything in good shape.

The party continued on with even more unique events such as a MIDI concert that involved a pianist in Ohio (Eugene Beer) playing Kim's synthesizer in California via a telephone modem and a paper glider contest (dropped from a tethered balloon). Kim's party was truly a multimedia affair and sparked an interest in ham radio with several of the guests. We're all looking forward to next year's event—I guess it'll have to be a virtual reality ATV party to top this one!

ABOVE & BEYOND

VHF And Above Operation

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Constructing Hamtronics Modules: Conversion of 28 MHz HF to 2 Meters SSB

Last month in this column I covered a basic concept; one method of converting an SSB HF rig using a VHF transverter, adapting an HF rig to 2 meter SSB operation. I detailed the HF modifications to my test device, an Atlas R-100 SSB HF rig. I used this rig because it was available to me for a modest cost. The basic point is that any inexpensive HF rig you locate is usable if it can cover the desired frequency range, in this case 10 meters (28 MHz). 10 meters is just a platform for generating and receiving SSB in this particular application. Any similar rig will work as it has all the basic circuitry to accomplish this goal. Whatever type of HF rig you base your design around you should be able to find a bargain in the used equipment or swap meet arena. Obtaining a used HF rig for this project and converting it makes good sense from both a time-saving and monetary point of view, in contrast to home construction of an SSB system for this use.

Using a Hamtronics Kit

As I stated last month, 1 selected the Atlas-R-100 receiver as the basis for my 28 MHz SSB portion because its circuitry is constructed to work in transmit or receive functions simply using a single PC board design. See the April "Above and Beyond" column for details. This month I want to cover the construction and interfacing of the Hamtronics transmit and receive modules to convert a 28 MHz SSB transceiver to 2 meters. Initially I was going to design a set of modules for this purpose but when I read the Hamtronics advertisement for their modules and looked at the cost, I could see this was a better deal than trying to re-invent the wheel. Besides, it's more fun to put a kit together than to engineer one.

Let me give you a few excerpts from the Hamtronics construction details that come packed with their equipment to give you an example of how easy they have made interfacing their kits. This excerpt is only a portion of the information supplied and deals with the attenuator needed for the transmit side of the circuit. See Table 1 for resistor selection values to construct a suitable attenuator.

There are many ways to come up with 1 milliwatt of drive at 10 meters. It is not possible to cover every example for each type of exciter, but the general information provided should be adaptable for your particular situation. The primary things to remember: First, be very careful to start on the conservative side when experimenting to find the best value to use. If you apply a massive amount of power to your converter you may end up with *smoke signals* instead of SSB signals. Second, do not reduce the audio gain of the exciter to keep output drive low, except for fine adjustment. Design your attenuator to use the full range of the exciter. Then you won't *blast* the transceiver accidentally with high power when the converter is in operation. Third, be prepared to experiment to find the ideal attenuator for your situation.

For low-power radios (less than 5 watts), you can simply build a symmetrical pi-attenuator to reduce drive for the converter. Mechanically, the attenuator is made of composition resistors of appropriate rating (be conservative) soldered to a vector board or terminal strip. Keep connections short and install any convenient length of coax cable and connections to complete the job. See Table 1 for attenuator values. It is sufficient to find resistance values close to the values given—it is not necessary to be exact! Make sure the resistors can handle the power level safely, especially the shunt resistor on the exciter side of the circuit, which dissipates most of the power.

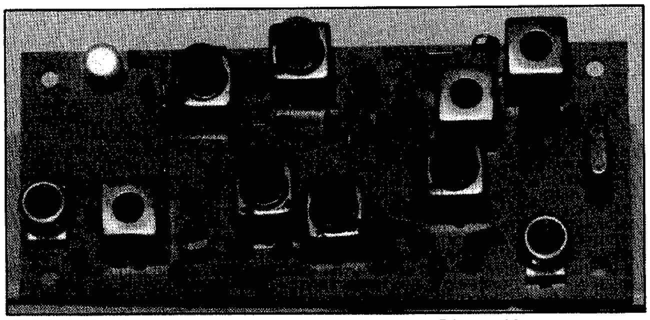

Photo A. Hamtronics receive converter CA-144-28.

The above description was part of the 11 pages of detailed instructions from Hamtronics to make the kit construction successful. They went into great detail, giving construction tips and line-up and testing procedures that were easy to follow for the most intimidated kit builder. I am not saying a third-grader could construct these kits, but with limited kit building experience you can feel comfortable putting them together. In retrospect, the only trouble I had in constructing the transmitter portion of the kit was trying to figure out where to use the solid #22 ga. wire. (It was used to hold shield sections in place.) My problem was that I missed the instruction on that item in my quick scan of Hamtronics material. If I had read the material more slowly I would not have missed that instruction.

The remainder of the construction was very straightforward and easy to follow. The only tools needed for the kit's construction were a wire cutter, long-nosed pliers, X-Acto knife, solder and soldering iron. The X-Acto knife was needed to remove the enamel on the wire used for the coil forms prior to soldering. The wire supplied was easy-strip and could be soldered, but I prefer to scrape my coil wire to clean copper. An alternate procedure for fine wire is to have a small capful of rubbing alcohol, dip the wire end into the alcohol and then with a match burn the tip of the wire. After a few seconds quickly dip the hot wire end into the alcohol. The enamel will crack off as the hot wire end is immersed into the cold alcohol. *(Keep the flame away from the alcohol.)* For safety, use only a small capful of alcohol. That is all that is needed anyway. *[Manufacturer's Note: New kits being shipped as of this month have molded coils, so winding on coil forms is no longer necessary. On the few air-wound coils which still require the builder to strip off insulation, be sure to pretin the coil leads after the coils are wound but before they are installed on the board. Thus, the heat is transferred to the wire and not sunk to the foil on the board.]*

All component parts for the kit were packed in a box with the PC board and instructions for that particular kit. All the components needed were sealed in a plastic bag. I suggest you obtain a small tray or box lid to place the components into before you open the bag so you don't drop something and lose it. I used a small photo tray about 4" by 6". Placing all components in the tray allowed the organization of resistors into a low-to-high-value assortment, allowing me to place and select them quickly during the construction of the kit. I used a section of cardboard and inserted the resistors into the corrugated end of the cardboard. If you have any trouble reading the color code you had better use a meter, just to be safe. (I know it, the color code, and assume you do also, but poor eyesight in low-light conditions predicates use of a VOM to confirm just what I think it is. This step avoids problems and is a good confirmation step).

Looking at the schematic and confirming component part locations on the PC board is quite easy after a few components have been placed on the

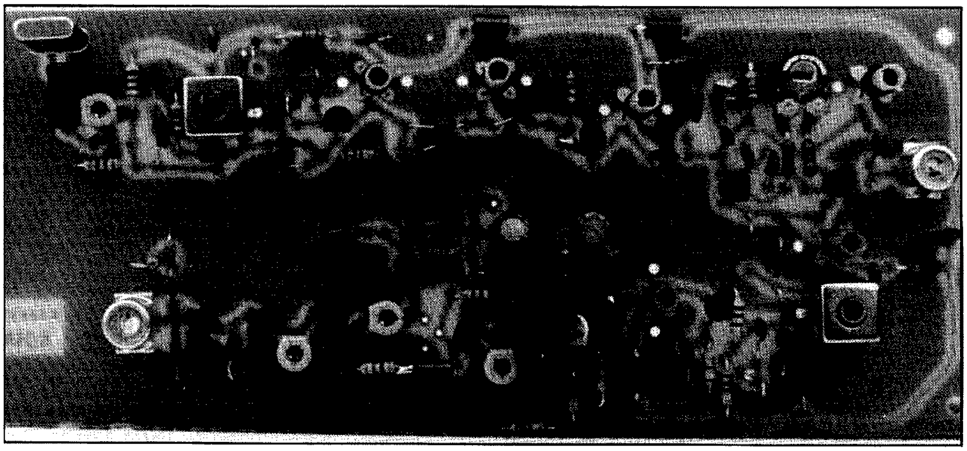

Photo B. Hamtronics transmit converter XV2.

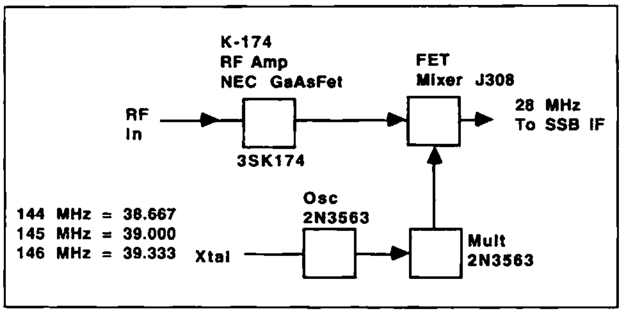

Figure 1. Block diagram Hamtronics CA-144-28 receive converter.

board. A suggestion for construction is to place some of the shields for the coils (without the coils) to give you a starting point until a few parts have been mounted. It helps to visualize the layout of components by separating portions of the circuitry. After a few parts are permanently mounted and soldered, remove them until later when the coils are positioned on the board.

After all the resistors were mounted I sorted the capacitors and used the same procedure as with the resistors. The coils for the receiver were all pre-wound and color-coded for easy installation. In the transmitter kit the 1/8" coil forms needed to be wound with the turns specified. The enameled wire for this was supplied in the kit. The remaining coils are air-wound with the #22 gauge enamel wire on a 1/8" mandrel for a form. Any 1/8" form will do here. The X-Acto knife was used to remove the enamel from the wire to bare the copper to aid in good soldering of connections.

The Hamtronics transmitter kit provides 2 watts of power output in the stock kit as constructed. This is far more power than is needed for upconversion in a microwave portion of the converter. I have tried several methods of power reduction to limit power to acceptable levels near the +10 dBm range (10 to 25 mW Max. of power at 2 meters). One method is to remove the final transistor and couple through this empty stage. Another method is to remove the +DC voltage to the collector of the final and use the remaining power that couples through the disabled final. In this method the transistor is still connected to the driver and provides a good match to its circuitry. The open collector with the tuned circuit and collector de-coupling still in place will reduce gain to acceptable levels for converter use.

For the Hamtronics converter this proved to be the best method and the simplest to serve the microwave converter with low drive. In any case, you could elect to incorporate a switching circuit in the microwave transceiver to have a 20 or so dB attenuator in the transmit path and switch it out for receive. This would reduce the 2 watts output to converter levels of +10 dBm. Next month I will cover a circuit that has this protection feature using a MMIC amplifier and relay-actuated attenuator. This unit serves as a protection device for the microwave circuitry to prevent accidentally keying a transmitter into a receive microwave mixer. It's a simple protection circuit. In the transmit path lies the attenuator to reduce the full power of the 2 watt power level to about 10 mW out +10 dBm for insertion into the microwave mixer.

There is an SPDT switch in the Atlas R-100 antenna circuit allowing the 28 MHz transceiver to be switched from the receive converter to the transmitter converter. This need not be a coaxial relay—a small open frame or dip-type relay is suitable. The power level, if similar to my conversion, is quite low and any similar type relay will work well. This relay is actuated off the R-100 keying line part of the original circuitry. Select a high resistance relay, like the Radio Shack mini relay part #275-248 ($2.99) or anything similar, for low-current operation. This particular relay has a 320 ohm coil and draws 38 mA when operated from 12 volts. I would prefer a little higher coil resistance but this one will do. See Figure 3 for the system diagram showing the entire inter-connections from the 28 MHz HF SSB driver to both receive and transmit 2 meter converters. As I mentioned, next month I will cover the construction of a simple switching circuit for the 2 meter portion of the circuit.

2 Meter Receive Converter

The construction of the 2 meter receive converter is quite straightforward. It was assembled in a similar manner to the transmitting converter; that is: resistors first, capacitors second, coils, then solid-state devices. In this kit all the coils were pre-manufactured on their particular forms and color-coded as to where the coils were to be positioned. This made construction very easy and fast. Again the instruction sheets for assembly were well-documented, with enough information to keep you out of trouble and to answer most questions about construction and testing.

The only difficulty I had was the adjustment of the coils' ferite slugs. The coils in the kit had square adjustment holes and I did not have such a tool in my tuning tool assortment. Hamtronics makes such a tool available but I did not know I needed one for the job. Their tool part number "A28" is 0.060" square. Not having one, I look an old hexagonal tool that was quite worn and fashioned a 0.060"-square shaft on the end of the soft plastic tool. I filed the part square and kept reducing the dimensions until it fit into the slug easily. For easy insertion, I fashioned the tip of this homemade 0.060"-square tool somewhat smaller than required. Be careful as the ferite material is quite brittle and will not take to force of any kind. If your tool can be inserted into the core three-eighths of an inch or more that's fine, as the force will be distributed about the slot and not just at the top. If you just insert the tuning tool into the top portion of the core and try to adjust the core position, the

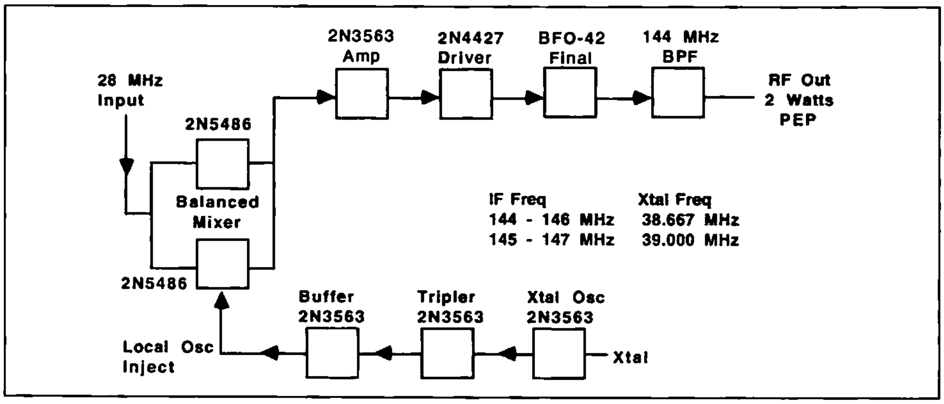

Figure 2. Block diagram of the Hamtronics XV2 transmit converter.

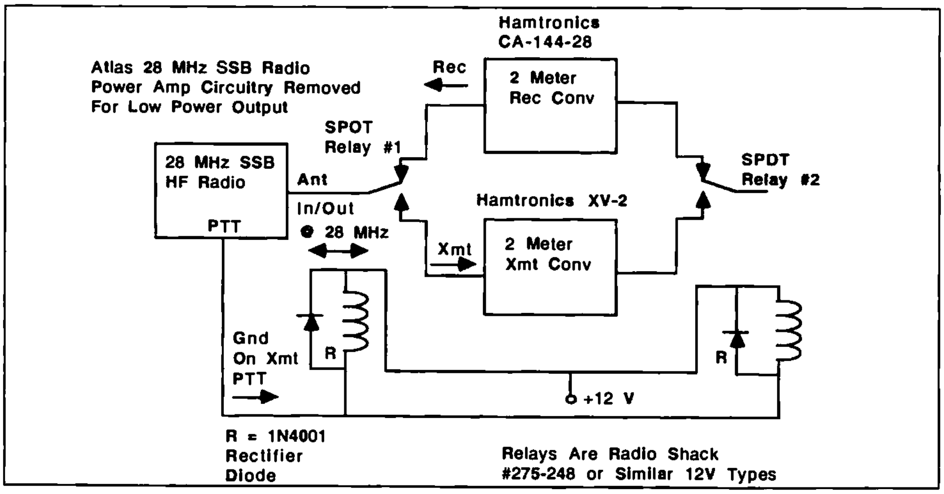

Figure 3. System interconnection diagram, HF to 2 meters.

possibility is very high that the core will shatter. You need a tool that will have a good bite and spread the torque about the core slot, instead of just at a part of the core material.

The safest thing to do would be to order the A28 (aluminum and brass) tuning tool when you buy your first Hamtronics kit. This makes sense because otherwise you risk fracturing the slugs, which are made of compressed powdered iron. At the same time, you could order a metal tipped variable capacitor screwdriver tool, if you don't already have one.

The remaining alignment and adjustment of the receiver and transmitter was quite uneventful. I guess the troubleshooting was made easy because of the many components that needed to be placed on the PC boards with care and confirmation, eliminating mistakes. Gremlins can creep in but I am sure you will have as easy a task as I did. With standard construction methods and all the fine material Hamtronics provided with their kit, they made the job easy. See Figure 3 for the interconnections needed to provide the switching necessary for the implantation of single-switch PTT operation on 2 meters with these modules. By the way, you can place the bare bones version of these modules without the microwave equipment attached for 2 meter SSB operation.

Next month I plan to cover the IF switch circuit particulars that will be adaptable to any system for VHF switching. The beauty of this circuit is that it incorporates a protection circuit for the microwave converter that prevents a high level of RF from taking a direct path to the microwave mixer. This can be an embarrassing if not expensive lesson in why we prevent high power from reaching a prized and expensive microwave mixer.

In the switching circuitry for the 28 MHz to 2 meter conversion (Figure 3) use small relays, available from Radio Shack. Remember: For good signal isolation, use two relays to prevent the relays from "talking to each other." The levels used in this switching path are low, as we don't use the full power of the 28 MHz SSB system (limited to about +10 dBm). Additionally, the Hamtronics transmit converter is also limited to low power by disabling the final 2 watt transistor stage to provide again low-level RF for microwave mixing. At this point keep the modifications simple as you might want to return this equipment to normal 2 meter use.

The final Analysis

Was the Hamtronics kit cost effective and did it provide a good base on which to construct a VHF platform for converting HF rig to 2 meters? *You bet!* My only thoughts on improvement would be to have a single PC board with the low-power rec/xmt circuitry for conversion to 2 meters done in such a way that its main use would be for microwavers' applications. Well, there I go again dreaming of the perfect application for my small problem. If we had it our way every time we wouldn't have any fun on the workbench. Besides, the modular design allows the most flexibility, such as for cross band OSCAR operation. I have to thank Hamtronics for providing their modules for our evaluation in this application, and to state that they performed very well. The kits and PC board were easy to follow and in operation performed flawlessly. I highly recommend these Hamtronics kits for your SSB HF conversion consideration.

Pad Value (dB)	Shunt R (ohms)	Series R (ohms)	Good for power level:
3	300	18	2 mW
6	160	40	4 mW
10	100	72	10 mW
14	75	120	25 mW
20	61	250	100 mW
30	53	790	1 watt
40	51	2500	10 watt

Table 1. Attenuator values for pad construction, 0 to 40 dB, for use in Figure 3.

Mailbox

Greg N8RXB writes: "I am trying to find a simple circuit for use as a 10 GHz detector to show the presence of a signal. A power indicator would be an added plus." Well, Greg, a single diode in a waveguide is the simplest circuit that can be constructed. Obtain a short piece of waveguide for the frequency of interest. In this case a piece of 1" by 1/2" guide about 1" to 2" long will work well. A microwave-type diode is needed and anything similar to a 1N23 will work well. This diode is packaged much like a 22 caliber bullet. The brass bottom case is made for grounding in waveguide and the top is the working contact of the diode. Some diodes are made in such a way that they can be pulled out of the bottom brass case and reversed in polarity. For our application either way will work well—you just have to change the indicator polarity to suit the diode polarity.

I just got a thank you reply back from Greg in the mail and he informs me that my suggestions work very well. He found an old security alarm circuit with a diode attached and reports that the circuit is doing the job nicely.

Dean Lucas N8VMD questions the antenna noise bridge (*73* magazine, February 1994). Dean does not know about the *RSGB Handbook* and is looking for information. Well, Dean, I will send you a copy of the circuit from the *RSGB Handbook*. The book is available from the ARRL library and costs about $30. It is published by the RSGB, i.e. Radio Society of Great Britain, Cranbom Road, Potters Bar, Herfordshire England EN6-3JW. The book is a collection of articles covering almost every aspect of VHF and UHF communications. It is slanted towards material found in the UK but as a sourcebook and idea book it is quite good in describing operations and methods. The author is G. R. Jessop G6JP.

Well, that's it for this month. As always I will be glad to answer questions concerning this and related topics. Please send an SASE for a prompt response. Chuck WB6IGP.

Number 23 on your Feedback card

Ask Kaboom

Your Tech Answer Man

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Failure Modes

A long time ago, I wrote a column called "The Way It Goes," in which I described the typical failures found in various kinds of parts, along with the relative frequency of failures, arranged by type of component. Let's take another look at that, this time concentrating on failures in semiconductors, which are by far the most common. Also, let's look at how a failed active component affects the parts around it. Just why do things stop working?

Reliability

If you're old enough to remember tubes, you probably recall pulling the tubes from your malfunctioning TV (or watching your dad do it) and taking them down to the local convenience store. There, you popped them into a socket on a giant tester and checked the tubes' emissions. Usually, one was quite low, and a new $3 tube was purchased. You got home, put them all back in and, wow, the set worked again.

Imagine doing that today! Widespread use of the transistor swept the old tubes and that big tester into oblivion, where they belonged. When solid-state circuits came along, we were promised they would be rugged, reliable and pretty much permanent. Were the manufacturers lying? Kind of. See, the transistor had the *potential* to be all those things, but getting it to actually live up to its promises was, and still is, something else.

At First

The earliest transistors were made of germanium. This material is a good semiconductor. In fact, it exhibits less voltage drop in the "on" state than does the silicon we use today. Unfortunately, it had other problems, the worst of which was its physically fragile nature. Even a little heat, or a good bump, could fracture a sliver of germanium, causing these parts to be very failure-prone. The average tube could easily outlast the average germanium transistor. Today, germanium is used only in special cases which require the smaller voltage drop. You can still buy germanium diodes, but the transistors are all but gone, thank goodness.

Cool, Man

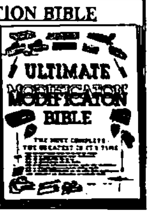
The tubes wore out because they had to operate at high temperatures in order to work. For a tube, heat is a necessary element. Also, because of the heat and the amount of power being dissipated, other components, such as resistors and capacitors, got fried too. (More on that later.) For a transistor, though, heat is no more than an unfortunate byproduct, because the electronic energy travels through solid matter (hence the "solid-state" moniker), so it doesn't need to be heated up to get it to fly through space. But, transistors do get warm. Sometimes, they get downright hot, especially if they have to handle lots of current. And, as with any material, high temperatures can break down molecular bonds and destroy the device. But what about small-signal parts which don't generate significant heat? Why do they break down?

> **"... CMOS is perhaps one of the most reliable technologies we have and, without it, most of the little, battery-operated toys we enjoy so much, such as pocket TVs and mini CD players, couldn't exist."**

Zap

One of the biggest causes of component failure is static discharge. A good zap will destroy just about anything, because the rampaging electrons actually burn a hole between layers of the semiconductor, allowing signal electrons to go where they don't belong. And, it's a cascading effect; once the damage starts, the applied power continues it until a total short occurs. And, although you'd think it would be an instantaneous process, as the old song goes, "it ain't necessarily so."

Transistors and ICs designed for very small signals and/or low-power operation tend to have extremely thin boundaries between layers; that's a big part of the reason small voltages can traverse them and operate these devices. It is, however, also a recipe for disaster. Even a small static discharge can punch a nice hole in such thin layers. But, if it's a small hole, the device may continue to work! Over time, though, the hole will get bigger until the device finally fails. It can take months. CMOS chips have built-in protection diodes to help prevent static damage, but it can still happen, especially when the parts are lying around loose. MOSFET transistors, which use essentially the same construction, also are vulnerable. It's not uncommon for a CMOS part which has been damaged by static discharge to work fine for quite awhile and then suddenly short out, so long after the damaging event you can't even remember it happened. I've seen RAM chips do that. Nonetheless, because of its ultra-low-power, cool operation, CMOS is perhaps one of the most reliable technologies we have and, without it, most of the little, battery-operated toys we enjoy so much, such as pocket TVs and mini CD players, couldn't exist.



Made That Way

There's another cause of semiconductor failure, and you can't do anything about it. Like anything else, the structures inside transistors and ICs aren't perfect; they often have extremely small bubbles and holes in them. We're talking sub-microscopic here; it takes a scanning electron microscope to see them. Over a period of months, or even years, electron flow through holes can cause enough damage to begin a short. Also, believe it or not, imperfections can narrow a conductor's effective area enough that it presents enough resistance to generate a small amount of heat. It ain't much but, at this size scale, it doesn't take much! Microscopic aluminum conductor lines can actually melt. Big chip makers employ chemists whose sole job it is to study these molecular phenomena and try to devise ways to prevent their formation. And, as the lines get smaller and smaller, the problem gets worse. If we're ever going to have reliable, affordable multi-megabit RAM chips, this issue will have to be resolved. As it stands now, manufacturing processes are a lot better than they were just a few years ago. That's a big reason why chip densities have risen so much, bringing us 486 micros and such.

The Bumpy Road

Can semiconductors actually break, in the physical sense? As I mentioned before, germanium was prone to doing that. Silicon is a great deal sturdier but, yes, it can happen. I've seen transistors fracture, especially if they were hot when the shock occurred. I've never seen an IC do it, though, but I suppose it could. Crystals, which aren't semiconductors, of course, but are made out of quartz, which is quite fragile when sliced thin, are the worst offenders. If you drop your rig onto a hard surface and any of its crystal oscillators stop working, suspect the crystal right from the start. I can't count the number of bad crystals I've run into, and many of them died from physical shock.

Can't Touch This

You don't need the high voltage of a static discharge to damage a semiconductor. Sometimes, even just a few volts will do, particularly with MOSFETs. And, believe it or not, just touching a lead can occasionally do the dirty deed, thanks to induced voltages and weak, unnoticeable static build-up on your body. That's why people who work with CMOS and MOSFET parts a great deal wear those grounded wrist straps. If you don't have one, it's a good idea to touch something grounded, like your scope ground, after you sit down and before you stick a finger on the circuit board.

The Domino Effect

In the tube days, enough power was being dissipated, and enough heat being generated, to damage resistors, capacitors and coils even when there wasn't anything wrong with the circuit! But with solid-state circuits, that's rarely the case. Sure, there are some power-handling circuits which can heat up and cause those old-fashioned troubles. Power supply regulators and power amplifiers come to mind. But in most circuits, signals are small, and the amount of power being dissipated is so tiny that there just isn't the potential to make much heat.

But, when a semiconductor dies, it often can do some damage to other parts. The usual cause is a shorted transistor or diode's pulling too much current through another component, heating it up to the point of destruction. Typically, the victim is a resistor of low value. Obviously, you can't pull a great deal of current through a 10k ohm resistor running off a 12-volt supply, no matter what you do; even if you put the resistor directly between the two supply rails, you'd only have 1.2 mA flowing, for a total power dissipation of 14.4 milliwatts. Most resistors are rated for at least 250 mW, so there's no problem. But, if the resistor is only, say, 10 ohms, now you're talking trouble, because enough current can flow to heat and crack the resistor. Consequently, emitter resistors in power amps are ripe for damage when the finals short out. Very often, they'll have small cracks which make them open or intermittent. Coils also can be blown that way, because they usually have low DC resistance. But, the heating effects which used to ruin capacitors in the tube days are all but gone; unless a cap is nearly touching a big power transistor, chances are it'll be unaffected by a blowout.

I hope you've enjoyed this little meander through the world of dying semiconductors. As the years go by, the parts get more and more reliable, but they still go and probably always will. Oh well, at least they don't have filaments to burn out. Now, let's look at a letter:

Dear Kaboom,

My Ramsey 2 meter kit radio picks up a lot of intermod. Granted, I live near some big commercial VHF towers, so I can't really fault the rig. Still, I'd love to be able to actually use it! Is there anything I can do to reduce the mess?

Signed,
Barn Door Open

Dear Barn Door,

The Ramsey kit performs about as well as most radios, but the company makes a special filter just for problem areas like yours. Give them a call and they'll tell you all about it.

73 'til next time, de KB1UM.

73 INTERNATIONAL

Number 24 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy
N. Swanzey NH 03431

Notes from FN42

As I am writing this column (March 3), we have just finished receiving six inches of the white fluffy stuff that falls from the sky, and I'm not talking about cottonwood tree cotton, and we are expecting another 2"-3" during the night. This makes storm #15 to come through New England this winter season. We are fast approaching the record for the most snowfall. I really don't care to break the record. I'm running out of space to plow the snow to.

Okinawa's Hambassador David Cowhig is moving to Taiwan in August. I'm sure that Okinawa will miss him, but he has promised to continue his reporting from Taiwan. David also sent some beautiful pictures of the islands around Okinawa and a very pretty QSL. I am submitting the QSL for print because of the very vivid colors of the fish and the blue water. I hope that the QSL will be printed in color. [Ed. Note: Sony Arnie!] *David also adds that Okinawa has 300 of the known 600 species of coral and some of the finest coral reefs in the world!*

Time for the news of the world—Arnie N1BAC.

Roundup

Ecuador Another "Program Notes" from HCJB, Voice of the Andes, reports that their 1994 QSL series features the people of Ecuador in bright color. Send in a complete reception report to augment your QSL collection.

Also, on Wednesdays, "Ham Radio Today": Get with other amateur radio fans and host John Beck for a half hour of features, tips, news, and helps for your hobby. Airs to the Americas at 0100, 0330 and 0530 UTC; to the South Pacific at 0800 and 1030 UTC, and to Europe at 0800 and 1930 UTC.

Pakistan *Received in the mail from the Pakistan Amateur Radio Society.* Reported in the January 1994 "PARS News Letter" were the following items: From January to December 1993, at least 20 new amateur licenses were issued by the PTC wireless Board Islamabad, great progress for 1993; the PARS QSL Bureau is working very well, having cleared all the incoming and outgoing QSL cards on December 31: Wahid Public School Islamabad is the first school in Pakistan licensed for an amateur radio station, AP5WPS, to promote the amateur radio hobby to the school's senior students; and evening classes for radio hams, Navy and Merchant Ships were started at Wahid Public School on 1 November.

For further information about PARS or to receive the "PARS News Letter," write or call: Pakistan Amateur Radio Society, Zone 21 PO Box 1450, Islamabad, Pakistan 44000 Region 3; Tel. 252858. *[The "News Letter" was six pages long and was very informative, with operating practices and procedures for radio hams, Ham Mailbag, and radio tips.—Arnie]*

Switzerland *From the ITU Press Notes:* Just in case you missed it, the following countries have received membership since January 1: Czech Republic (Jan 1), Georgia (Jan 7), Slovakia (Feb 23), Kazakhstan (Feb 23), Micronesia (Mar 18), The Former Yugoslav Republic of Macedonia (May 4), Turkmenistan (May 7), Eritrea (Aug 6), and Andorra (Nov 12).

The TELECOM 95 FORUM, to be held in Geneva in conjunction with the TELECOM 95 exhibition from 3 to 11 October 1995, has been drastically rethought in light of the changes in the policy, economic, regulatory, financial, development and investments aspects of telecommunications that are now intimately entwined with technology. Innovative in concept, form and substance, the FORUM will consist of two summits, one on strategies and one on technology.

"By establishing a truly open door policy, the FORUM is a unique opportunity to bring all these interest groups together."

The Forum aims to open up a true dialogue with all relevant companies and organizations affected by the current information technology revolution. "By establishing a truly open door policy, the FORUM is a unique opportunity to bring all these interest groups together," says Pekka Tarjanne, Secretary-General of the ITU, "It will allow the telecommunications industry to explain what it has to offer, and the users' community to articulate its requirements."

The theme of the Technology Summit, "Convergence of technologies, services and applications," will explore in three parallel conference tracks the following issues: communications services for the individual, communications services for business, and national, regional, and global issues.

The Call for Papers for the Summit encourages submissions from all industries involved in or affected by the new telecommunications environment and from governments of all countries, be they developing or developed. The deadline for the receipt of abstracts is August 15, 1994.

For further press information contact Francine Lambert, Chief Press and Public Information; for information on submitting abstracts contact Lili Rison, Project Manager TELECOM 95. Both are at International Telecommunication Union, Place de Nations, CH-1211 Geneve 20, Switzerland.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530

4X1KT Memorial Packet HF-VHF Gateway Station Up and Working Corrinne Yehudah 4X6VT reports that she has got the 4X1KT memorial packet gateway up and working on the air at Kiryat Yam, a northern suburb of Haifa. Using the late Tzvi Pomer 4X1KT's gear donated by his family, the station is already relaying the traffic between the Haifa 4X4HF BBS and abroad.

When 4X1RU stepped down at the end of December, 4X1KT completely took over the Israeli international forwarding. Corrinne reports that this has been an amazing learning experience, and in one day she managed to pass 1.5 megabytes of traffic with a Greek station. Help has been offered also from Germany and Italy for relaying traffic and bulletins as far as the low sunspots will permit. 4X1GP, 4X1RU, and 4X4XM, to mention a few, have been most helpful getting Corrinne going both with the hardware and software.

Corrinne, who for the past few years has been managing the outgoing IARC QSL bureau, observes that both the bureau and the gateway are like a kitchen sink: No matter how many dishes you wash, there are always more waiting!

The function that 4X1RU served as a BBS for the Tel-Aviv and Central area node (HRZ) has been taken over by the new 4Z4AAA BBS and TLV node run by Yaacov 4Z5AY. There were about three days of silence in the area at the beginning of the year until Yaacov and his crew got everything up and running, otherwise the transition was completely smooth. Now the bulletins from all over the world are daily filling our monitor screens, and we are still blessed with a beautifully functioning packet system.

Many thanks to Jim 4X1RU for all his years of service as BBS SysOp and VHF-HF gateway station. Jim is still active on packet, but now as a private station, and is providing the 4XNet system with fresh AMSAT bulletins, a service much appreciated.

More Pirates Bite the Dust! After we all thought that the Ministry of Communications was impotent and the IARC had won a court precedent that it could have the police arrest pirates and willful interferers and take them to trial, the Ministry's Monitoring Unit has caught a few bootleggers. Although the information that has reached us is sketchy, apparently one of the offenders was in Kibbutz Hamadiya, using the club callsign of a neighboring kibbutz.

Another one was in the Haifa area. A lot of amateur equipment was confiscated. He is now trying, in a crash course, to acquire the required proficiency to pass the next Radio Amateur Examinations, and has offered all the seized equipment as a gift to the IARC!

Another two, reportedly in Herzliya, were using unlicensed amateur gear and were jamming wireless telephones.

4Z85TA Celebrates Tel-Aviv's 85th Birthday From January 1 through April 30, 4Z85TA, a special station commemorating the 85th anniversary of the founding of the city of Tel-Aviv, will be on the air. All modes (and we mean all—CW, SSB, SSTV, packet, AMTOR, PACTOR, and RTTY) will be operated on all the bands, and possibly via satellite as well.

Shlomo Musali 4X6LM, the manager of the station, promises a special QSL for every contact made, and says that a diploma will be available. The conditions necessary for winning the award will be published as soon as known; in the meantime, make it a New Year's Resolution to get on the air and work the station on as many modes and bands as you can!

OKINAWA

David Cowhig 7J6CBQ/WA1LBP
AmCon Naha
FBU PSC 556, Box 840
FPO AP 96372-0840

Summer '93 brought the Taiwan-Japan-Korea-Russia UHF test in late July and portable operations at the many festivals held in Okinawan cities and towns. The Kadena Radio Club operated the UHF test from a hilltop site at Tanodake in northern Okinawa. Taiwanese, Japanese, Korean and Russian stations participate in this annual propagation test. JS6YLV worked a BV Taiwan station on early Saturday afternoon and then turned its beams north to work into Kyushu and Honshu Saturday evening and Sunday. A strong typhoon which hit southern Honshu on Saturday evening reduced activity from that area considerably! The JS6YLV hams proudly told me of how they contacted another island 200 km to the north by ATV (ham television) on 1200 MHz a few years ago from the same hilltop site. The 430-440 MHz ham band is not used for ATV in Japan; 1200 MHz and 2400 MHz are the ATV bands here.

Another group of hams operated from the Onnason Festival. Onnason, a spectacularly beautiful resort, lies halfway up the Pacific coast of Okinawa. Onnason is proud of its early 18th century woman poet Onna Nabe who wrote this verse, the most famous of the Ryukyuan Songs: "I gaze upon the Onna hills/Towards my lover's home village/I want to push the mountains aside/And draw him here to me." Okinawan literature and music, a won-

derful synthesis of old and new with many elements borrowed from mainland Japan, China and South Asia, reflects the passionate feelings and friendly "i-chari-ba-chode" (to feel like brothers on the first meeting) spirit of the Okinawan people. "I-chari-ba-chode" translates best into English as "Aloha"—Okinawa history and culture have innumerable parallels with the Aloha State. One-fourth of the Japanese-Americans of Hawaii trace their families back to Okinawa.

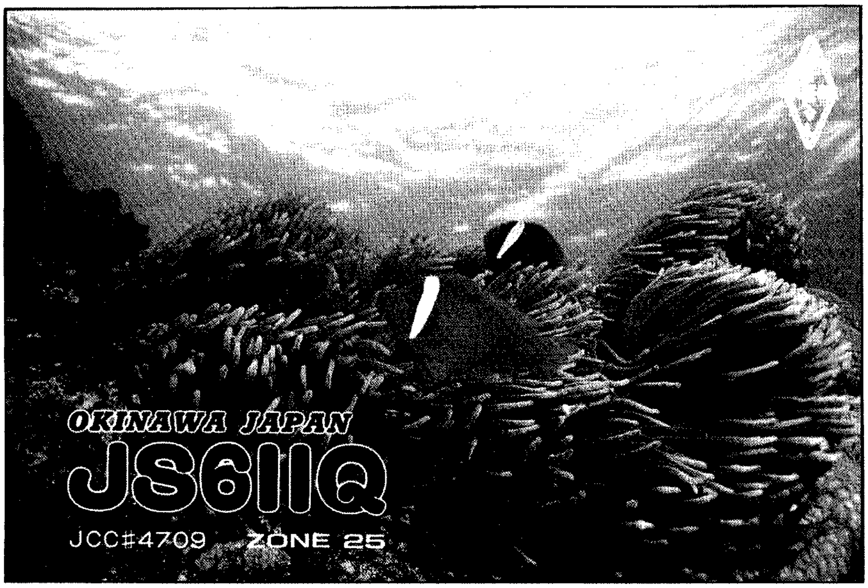


Photo A. QSL card from JS6IIQ.

In mid-August the first Okinawan Radio Direction Finding Contest was held in the Prefectural Forest near Onnason. The two hams who found the six transmitters in the shortest time won the right to represent Okinawa in the annual Kyushu regional radio direction finding event. Both winners used a 2 meter hand-held yagi/receiver unit manufactured by Mizhuno Radio Co. The 145.18 MHz Foxhunting Friendship Club regularly holds mobile foxhunts one Thursday night a month in southern Okinawa with a nice late-night snack at the site of the fox—the hidden transmitter.

Tourist hams from other parts of Japan listening to the 2 meter band here for the first time are surprised that so many hams here speak Okinawan, a Japanese dialect nearly incomprehensible to Tokyo dwellers. As I write this in January 1994, many of the 1,200 Okinawan hams (6,000 people have ham licenses) are saying "e so- gatchi de-bi-ru" (Happy New Year) to one another in Okinawan as well as the "a-ke-ma-shi-te o-me-de-to go-zai-masu" (Happy New Year in standard Japanese). Okinawa Prefecture (population 1.2 million) has tremendous dialect differences from island to island. Saying thank you, for example, in standard Japanese is "arigato"; for hams speaking dialect on the main island of Okinawa, "ni-hey-day-bee-lu"; on Miyako Island "tandy ga tandy"; and on Yonaguni island, 80 miles off the coast of Taiwan, "fu-ga-la-sa."

To get to the point where they could say "e so-gatch de-bi-ru," Okinawan hams ran a gauntlet of Forget-the-Old-Year Parties (bonen kai) starting in mid-December. After the fine bonenkai of the 145.18 Foxhunting Friendship Group, where we saw a display of foxhunting antennas and enjoyed the fine view from atop the Hotel Ekka in Naha, many of my Okinawan ham friends got ready to go to their second party, to be followed by a third in some cases! In January many people go to New Year's parties as well. Okinawan hams know how to have fun! 73

NEVER SAY DIE

Continued from page 4

there I asked where they were in issuing W4 calls. They checked and said they were just handing out W4NSA at that time. I said to hold W4NSD for me please, which they did. I put in for it while I was there and returned to Southern Pines that night with my first class commercial ticket and my W4NSD license.

I'd brought along my kilowatt NBFM rig, so I had a great time working DX from there. Later I moved to Sarasota, Florida, to work at WSPB, where I was active on 6m and 20m.

In 1951 I moved to Cleveland, Ohio, and applied for W8NSD. I'd put off my application so long that by the time my new call arrived I was fed up with working there and was about to move back to New York. That was the year I operated the first weekend of the ARRL Sweepstakes contest as W2NSD/8 in Cleveland, and the second weekend from New York as W8NSD/2. I had separate rigs, so the only thing in common was my D-104 microphone.

Sometime after that the FCC stopped making such parallel calls available. So when I moved to New Hampshire in 1962 they couldn't give me W1NSD. But they said that they expected to change the rules so I would be able to get the call and to operate as W2NSD/1 in the meanwhile. I had a permanent address in New York at my folks' house, so it was legal. I kept sending in the required notices of portable operation, waiting for the promised rule change. This went on for years. Then, in the '70's they eliminated the portable notification rule. But they never made it possible for me to get W1NSD, so I said to hell with 'em and have been using my W2NSD ever since. I may have set a record for portable operation. It's been 32 years now! Anyone beat that?

So what call would I swap for my old W2NSD/1? Well, I have to admit that I did get a kick out of operating JY1 from King Hussein's palace. So the call of my choice would be "W." Stands for Wayne. Yes, I'll pay. How much do they want? How's that for an ego trip? Would I accept W1? Well, perhaps. So who are they going to sell W to?

Media Inertia

First I want to thank the dozens of readers who wrote in asking for more information on the AIDS cure. I want to particularly thank those who have been putting up with my writing about anything I think will interest you.

The new year was particularly exciting for me because I felt I had some earth-shaking news ahead of the popular media . . . news which would eventually make headlines. The most exciting was the AIDS cure news. Next, by a nose, was the news of what's been developing in the cold fusion field. Imagine, a cure for the world's worst disease and what looks like a new source of unlimited power from nickel and water! Then I got word of a simple and inexpensive new process for converting radioactive waste isotopes into non-radioactive elements and isotopes. Wow! This process seems connected with the cold fusion process.

I wanted to get the word out on these incredible developments as quickly as I could, so I dropped notes to several magazines, asking if they were interested in getting more information. I wrote to *Time*, *Newsweek*, *US News*, *Omni*, *Discover*, *Scientific American*, *Forbes*, *Fortune*, etc. The only one I've heard from after several weeks was *Omni*, which sent me a form rejection letter.

Oh yes, I also wrote to my senators and congressmen, the governor, Bill and Hillary, Al and Tipper, and a few other elected officials. No word.

Is it that no one of importance reads their mail any more? I read mine, but then I probably don't count as a person of importance, except in my own mind.

Meanwhile, word of the AIDS cure has been appearing in a few medical journals in the US, Canada, and Australia, so that may get around without my help.

The AIDS Circuit

Though the circuit itself is dirt-simple, I wanted to provide as complete instructions to its use as I could so I wrote the whole works up and printed it as an eight-page booklet. I've sent this to everyone who wrote asking me to publish the circuit. No charge. But I have asked for donations to help me get the word out with PR and ads. I've asked that anyone who has AIDS and is cured as a result of my information send me $100 which will be used solely for the promotion of this cure.

If I get enough donations I'll try to find someone to put together easily-built kits of parts to help make this even easier. I've also asked that anyone experimenting with this approach keep careful notes and send me a copy.

Golly, it was back in 1964 that I got involved with putting together parts kits. I wanted to help the *73* readers be able to build the construction projects we published. I tried first to interest an outside company in doing it, but couldn't find anyone interested. So I hired a ham from Milford, the next town east of here, to handle the kits. It meant building a test unit, writing up the detailed instructions, buying the parts, listing the kits in the magazine, then packing and shipping the kits

when they were ordered. Sounds simple, eh? What a hassle!

When he got hopelessly screwed up with this I moved him on to something else and tried a ham from Keene, the next big town to the west. The kits were late, ads wrong, parts not ordered, and so on. I finally gave up and did it myself. I bought all my parts from Evans Radio In Concord, NH, wrote the instructions, picked the parts, wrote the labels, and had a good business going.

But I was also busy publishing not just *73*, but also *6 Up*, *5-7-9*, *ATV*, and a club newsletter editor newsletter. *6 Up* was a VHF-UHF newsletter. *5-7-9* was for contesters. These four newsletters were written by experts in the fields, edited by the *73* crew, and I printed 'em all on an AB Dick 360 press in my garage. I had local high school students come in after school to do the collating, stapling, and addressing.

This was all working fine except for a couple of teeny weeny little problems. First, and least significant, was that I was paying the kids 50¢ an hour to work. They loved it, but that was less than the minimum wage, so I had to fire them and put in a collating machine and an automatic addressing machine. That saved me money, but put the kids out of work. They used their new spare time to get into trouble.

The second teeny problem was my divorce from my first wife, which really threw me for a loss. I got so sick over it that I couldn't work more than a few minutes a day without collapsing. So I had to stop publishing the four newsletters. I ended the parts kit program. I turned the Institute of Amateur Radio over to one of the directors to run, and hired a manager for *73*. The Institute director quickly bled the membership bank account dry. My manager/editor did an outstanding job of trying to put *73* out of business. He stopped sending out renewal notices. He canceled several thousand subscriptions. Then he walked out and left me with not only that mess, but with not one single article for the next issue. He took along my circulation manager, and my entire production department. He tried to hire away my assistant editor and bookkeeper, and so on. He used all the articles to help start *Ham Radio*, a move which tended to put a strain on our relationship from then on.

It's been a long time since I've written about the early days of *73* . . . I'll have to tell you some of the stories about those times.

So now I'm considering getting back into handling kits again. Well, a kit, anyway. But if it'll help save a few thousand lives, I'll be glad to help. Maybe I'll be able to find someone this time who'll be able to run a small kit business for me. Oddly enough, when I first heard about the AIDS cure we tried to get two ham kit companies to do this one . . . and they wouldn't.

DRA

This is my latest attempt to try and get some intelligence into ham QSOs. I suppose I should just shut up about this and stop grumbling. Hams, trapped by an age-old technology where they can only talk or listen, but not both, will probably never be able to maintain many interesting conversations. Oh, I've come up with some fairly simple ways to get duplex contacts going, but to no avail.

Back when I was in the fifth grade at the Oyster School in Washington, DC, they had a clever way of getting all the students to read the paper every day. That's more than most kids do now, right? They had a dummy microphone in the class and each student had to get up and give a news item from yesterday's paper. We had to be prepared with several items because no duplication was permitted. That had us reading the papers, looking for unusual and interesting items.

The DRA stands for "didya read about." The idea is to clip interesting items from newspapers and magazines and have 'em handy near the rig so you can pick one up and ask DRA.

I don't know about you, but I read a ton of magazines (but no newspapers) and I'm a clipping fiend. Call me the Yankee Clipper. I pull the pages out of magazines on politics, health, EMF, and so on. Just under C I have clipping files for capitalism, child care, classical music, Clinton's plans, clothes, cold fusion, colleges, computers, Congress, copy writing, cosmology, crime, and cutting government.

If you've worked me recently on the air the chances are that I somehow managed to steer the conversation around to AIDS or cold fusion. But if you have anything that interests you, the chances are good that I'll be interested too. I just want to talk about something other than what rig or antenna you have. I like to use our communications medium for communicating. I want to know what work you do, what other hobbies and interests you have, and anything new that I might have missed.

Many readers delight me by finding articles in their local papers they think will interest me and sending me clippings. I really enjoy that. So keep a pair of scissors handy and clip for your file. And if you find something you know I'm interested in, send me a copy. OK?

Loony Tunes . . .

That's the answer some scientists have used to ridicule others for continuing to research the cold fusion phenomenon. Many areas of research are

cut off from any significant funding by the Loony-Tune derision. Of course there's nothing new about this, as I've explained before. The Wright Brothers were ridiculed as frauds for several years after their maiden flight. It was so bad that they left America and went to France, where their work was appreciated. The same thing Pons and Fleischmann did.

There are so many areas that scientists should be researching, but are prevented by ridicule, that if we are ever able to overcome that reaction by the pathologically skeptical, we'll be able to enjoy more progress in understanding the world and life than anything we've seen in the past.

There are so many "crazy" things that science has ignored that I can only list some of the major ones that come to mind. I've read enough books to convince me that we need to find out a lot more about death, reincarnation, the spirit world, psychics, psychic healing, clairvoyance, fortune telling, psycometry, predicting the future, UFOs, UFO contactees, auras, spoon bending, prayer, communications between and with plants, dental amalgam, vitamins, light, bioelectromagnetism, electromagnetic fields and health, mob psychology, magnetism, communications with extraterrestrials, near-death experiences, out of body experiences, mind reading, limb regeneration, light and health, all that missing dark matter, serendipity, coincidences, past lives, acupuncture, herbal medicine, homeopathy, chiropractic, the placebo effect, music and health, fire walking, speed healing, psychokinesis, long delayed radio echoes, and so on. How do Ouija boards work? How about automatic writing? How can yogis control their heart rate, body temperature, blood flow, and so on? Is dowsing all baloney?

As I've mentioned, you can become a research scientist in your own home with nothing more than a bunch of beans and some pots to grow them in. You can experiment with the effects on their growth of being exposed to either the north or south pole of a magnet, exposed to different colors of light, to AC fields, to radio fields, and even to prayer. Yes, I know it looks stupid to pray to a bean, but wait'll you see what it can do! Try some beans up near your linear, with some at a distance as a control. And some near your TV set.

By the time we've opened up most of the fields I've mentioned we're going to know a lot more about our world, about life, and even maybe begin to understand a lot more about God.

One nice thing about quantum mechanics was that it knocked the stuffing out of the old-guard scientists. Most reacted by refusing to accept it. I've told you Max Planck's response to that. And sure enough, the old-timers gradually died off, taking their refusal to believe in quantum theory to their graves. Well, we have our own version of that with our believers in CW. Oh, CW is fine, it just shouldn't be a religious matter. And it also shouldn't be used to make amateur radio a skill hobby instead of a technical hobby. CW requires no mind at all. It's a subconsciously developed skill. I prefer to have amateur radio depend on expanding the mind, not killing it.

Perhaps, without our need for ever more complex and expensive military weapons, we'll be able to devote more money to non-military research and development. The latest figures I've seen have put the American overall scientific budget at about 80% military-oriented. That stinks. How much more technology do we need to butt into countries where we have no strategic interests? There are dozens of countries all around the world where our media will be pushing us to send in our military for humanitarian reasons. Well, atrocities sell papers and build TV ratings, plus they give Congress an excuse to keep up their military pork spending. Let me know when you think you are getting tired of being manipulated by the media.

One of the results of the ridicule in America of cold fusion researchers is that most of the exciting developments in the field are happening in other countries. We're getting left further and further behind. The latest report is from an Italian group who've got a system working that they can turn on and off at will, and which, once started, generates around 300 kilowatts using only three grams of nickel and some hydrogen for fuel. They haven't gone public with this yet, so we'll see if it's real when they've finished their patent applications.

The time was when hams led the communications industry in the development of new technologies. We pioneered FM. We pioneered NBFM, SSB, SSTV, and repeaters. We even pioneered TV. Some of the early commercial TV people had cut their teeth in an amateur TV studio in Long Island City. When I worked as an engineer and then as chief cameraman at WPIX (channel 11) in New York back in 1948 several of the people working with me were alumni of the Long Island studio.

There are many areas wide open for hams to research and pioneer, once we stop being scared off by the commercial research scientists. We have an enormous advantage over them in that they know that when they tackle a project they'd better damned well come up with a positive result. It's a vicious world out there for scientists. Amateurs are gambling their own time and money. This is why most of the major new breakthroughs in technology have been made by amateurs. When we win we're heroes. When we miss, we're the only ones who need know about it. And we're not under any publish-or-perish threat.

I'm Proud to be an American!

Just look at everything we have to be proud of. We all know that America is the greatest country in the world. Love it or leave it, right? Well, we all love America. And we are justly proud of a country which used to be the car capital of the world. Which used to be by far number one in electronics and high-tech.

Well, we're still number one in a great many ways and we shouldn't forget it! We have one of the most corrupt governments in the world. We have one of the most expensive and least effective school systems in the world. We have one of the most expensive health care systems in the world. We have some of the most corrupt unions in the world. We have the worst crime problem of any country in the world. We have more murders per capita than any other country. We have more racial strife and bigotry. We have one of the worst drug problems in the world. We have more lawyers and lawsuits per capita than any other country. We have the highest federal deficit in the world. We have the worst trade deficit in the world. We have the most dangerous cities in the world. We have the best music in the world, but of course, 83% of our music comes from foreign-owned companies (mostly Japanese). We have more people in prison per capita than any other country. We have the wealthiest organized criminal groups in the world. We have more employees in government than in manufacturing. And we're world-class when it comes to encouraging entrepreneurs . . . to tap our government via HUD, food stamps, and endless health care scams, all dutifully reported on our exposé TV shows.

"And most of all, I'm truly proud of my fellow Americans, who are able to stomach all this corruption and waste without a whimper."

We can well be proud of our street gangs, our riots, our welfare system, our decaying cities caused by rent control, our polluted rivers, our radioactive and industrial waste record, black family disintegration, smog and air pollution, the IRS, Bill and Hillary, our obscene music lyrics, guns in schools, vapid sitcoms, illegal immigrants, our foreign aid program, our lobbyists in Washington and all state capitols, our porno industry, our military procurement system, our banking mess, our savings and loan mess, our tobacco farmer subsidies, corruption on Wall Street, NASA's monumental inefficiency, our eager acceptance of eco-scams . . . you continue the list please.

Rome had its circuses, with Christians fighting lions and each other. We have TV so we can gawk at mayhem in Bosnia and Somalia, so we can spend our days enjoying important things like a severed penis, an attacked skater, our Bureau of Firearms wiping out a dangerous colony of religious nuts, and more religious nuts fighting or defending abortion. We relish every murder in the news, and then turn to crime shows for more. We shine our media spotlight on any protest group. We fan the flames of sensitivity. We're sensitive to women, to homosexuals, to the "disadvantaged," to blacks, to the poor, to the short, the fat (so don't eat so damned much, fatty), the homeless, the lunatics, and so on.

I'm proud of our choice of presidents. Of Lyndon Johnson who so enthusiastically pursued the expensive and lost war in Vietnam and launched the long, expensive and lost war on poverty. Of Nixon, who still insists he was not a crook. Of Ford, who gave us lots of laughs. Of Carter, who gave us hyper-inflation. Of Reagan, who gave us the movie star president we'd always dreamed of. Of Bush who gave us . . . gave us? Oh yes, of Bush, who finally fed us up with both the Democratic and Republican parties, forcing us to lean on Ross Perot . . . who then crumbled under the weight.

And most of all, I'm truly proud of my fellow Americans, who are able to stomach all this corruption and waste without a whimper. I'm proud of how our factory production school system has changed what was once a fiercely proud nation into a nation of wimps. I'm enjoying the spectacle of a people trying to enact a constitutional change to limit terms . . . please stop me from endlessly re-electing my crook. And another to balance the budget . . . please stop me from letting my representatives spend my children's money. I'm proud of our stomach for congressional pork.

What other country would allow pedophile (man-boy love) groups to parade? Would provide police protection for hate groups to parade? Would listen by the millions for hours a day to Rush Limbaugh, Howard Stern, and G. Gordon Liddy? What other country would watch Donahue, Oprah, and Geraldo on TV every day exploiting sickos?

I hope you are as proud to be an American as I. I'm proud of the National Rifle Association and the American Association of Retired Persons for their effective lobbying, no matter what it is doing to our quality of life. Do you know that we have the most corrupt newsstand circulation system in the world? And the most corrupt music industry too? When it comes to superlatives, we've got most of 'em cornered.

Now, if you happen to be a troublemaker and less of a Pollyanna than I, you might look at the downside of some of the superlatives I've listed.

Yes, the Mafia is ruthless and into hundreds of businesses, but by golly, it works! It works fabulously. The average Mafioso makes well over a million a year, and what spells success more in America than making big money?

When we heard that Perot was a multi-billionaire we wanted him for president, and never mind some screws that seemed to be loose. Maybe we'll run Bill Gates next time. Bill, who I happen to know personally, also has some screws loose, but the recent media campaign to make him a household word should should successfully hide those blemishes.

But even if someone were to actually get upset over the negative aspects of the things I've mentioned, we're all on this big train going a hundred miles an hour toward hell and there's nothing any of us can do to change things. Right?

Wrong, actually. I've got a challenge for you. Let's see how creative you are. What is one thing that you could do which could change almost everything many probably clinically depressed people see as negatives? Let me make that even more of a challenge. What is one thing you could do which would take an average of about 12-seconds a day and which would inevitably change the welfare system, the social security mess, the deficit, crime, crowded prisons, the drug war, foreign aid waste, unemployment, housing values, lower taxes, and so on?

Now, if you look back over the list, you'll see that virtually every outstanding misery in our country comes down to being caused or encouraged by the government. The government *you* elected and are paying for.

Is the situation hopeless? Yes, unless *you* change. Look, your politicians aren't going to change by themselves. It isn't going to be easy to change them . . . but it actually can be done. Here's a scenario for you to think about. Let's suppose that no matter how good an elected politician seems to be doing his job, that without fail he is replaced in the next election by someone new. This would kill the congressional seniority committee system, which lies at the heart of most of our problems. Many congressional freshmen come in hoping to make changes. It doesn't take them long to learn that they either play ball or they'll get zip. No committee appointments worth spit No pork. Nil.

Never, ever, re-elect any politician. If we keep flushing the toilet long enough we'll finally begin to see clean water in the bowl. One term. Period. Next! I'd love to see NMI bumper stickers all over the country. No More Incumbents. Is this something your radio club could do?

Number 25 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our **BBS (603-924-9343)**. for listings that were too late to get into publication.*

MAY 1

BEMIDJI, MN The Paul Bunyan ARC of Bemidji will hold its annual Hamfesl from 8 AM-2 PM. Flea Market. VE Exams. Dealers. Talk-in on 146.13/.73. Contact *Steve Hake, Hamfest Chairman, 4331 Pincherry Rd., Bemidji MN 56601. Tel. (218) 751-9558.*

BURLINGTON, IA Valley Emergency Comm. Assn. will host Burlington Hamfest '94 from 7:30 AM-3 PM, at the Burlington Drive-In Theater on Agency St. Talk-in on 146.790/.190 W0LAC/R and 146.520 simplex. Contact *Chuck Gysi N2DUP, Burlington Hamfest '94, P.O. Box 911, Burlington IA 52601-0911*, or call *(319) 752-3000 (voice/fax).*

HERKIMER, NY The Fort Herkimer ARC will hold a party at the Herkimer County Home for the Aged, from 1 PM-3 PM, to celebrate "Dean Wallace Day," in of honor Dean K2ANM, Oldest Active Amateur Radio Operator in Herkimer County. Dean, who was bom in July of 1899, was first licensed in 1919!

YONKERS, NY The Metro 70cm. Network will present a Giant Electronic Flea Market at Lincoln H.S., 9 AM-3 PM, rain or shine. VE Exams. Talk-in on 440.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 Hz; and 443.350 MHz PL 156.7. Mail reservation payments to *METRO 70 CM NETWORK, 53 Hayward St., Yonkers NY 10704*. For details, call *Otto Supliski WB2SLQ, (914) 969-1053.*

MAY 7

EAST LIVERPOOL, OH A Hamfest will be held by the Triangle ARC from 8 AM-3 PM at Calcutta Fire Hall. Talk-in on 146.70. Contact *Dick Sisley K8JKB, 1218 Northside Ave., East Liverpool OH 43920.*

GRASONVILLE, MD Kent Island ARC will hold their Hamfest at Grasonville VFW, from 0800Z-1400Z. Talk-in on 146.94 Rptr. Contacts: *Tom Dove K3ORC, (410) 643-4675; Glenn Durbin WN3G, (410) 643-1125; Jim Smith K3UBC, (410) 643-3338; Jerry Miante K1JUM, (410) 643-2782.*

MANITOWOC, WI The Mancorad RC will hold its annual Hamfest, starting at 8 AM, at the Manitowoc County Expo Ctr. Amateur/Computer/Electronics Flea Market. VE Exams. Mail checks w/SASE to *Mancorad RC, P.O. Box 204, Manitowoc WI 54221-0204*; or call *Red, (414) 684-9097 days; Ron (414) 793-4733 eves.*

OWEGO, NY A Hamfest sponsored by Southern Tier ARC will be held at Marvin Park Fairgrounds from 8 AM-4 PM. VE Exams. ARRL Forum. 35th Annual Banquet. Flea Market. More. Talk-in on 146.16/.76 or 146.52/.52. Contact *STARC, P.O. Box 7082, Endicott NY 13761-7082.*

SIERRA VISTA, AZ The Cochise ARA will have their annual Hamfest from 7 AM-4 PM. For VE Exam info, call *Frank Ivey, (602) 378-9404*. For Hamfest info, contact *Tim Mize, (602) 458-5257*. Talk-in on 146.76/.16.

MAY 8

ATHENS, OH The Athens County ARS will hold its 15th annual Hamfest and Flea Market from 8 AM-3 PM at the City Rec. Center. Indoor space is available only by advance registration; Contact *John Biddle WD8JLM, 80 Wonder Hills Dr., Athens OH 45701. Tel. (614) 594-8901 after 6 PM.* For info, write to *Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701-1939.* Talk-in on the Club repeater at 145.15 MHz (-600).

MEDINA, OH The Medina 2 Meter Group, Inc., will hold their Ham/Computer/Electronic Hamfest at Medina County Community Center, 735 Lafayette Rd. Flea Market Set-up at 6 AM. For details, contact *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258. Tel. (216) 725-4492, 10 AM-5 PM.*

MAY 14

CADILLAC, MI The annual Swap and Eyeball QSO will be held by the Wexaukee ARC at the Cadillac Middle School. Talk-in on 146.98 Rptr. Contact *Wexaukee ARC, P.O. Box 163, Cadillac MI 49601*; or call *Dan KE8KU, (616) 775-0998.*

ETOBICOKE, TORONTO, CANADA The Skywide ARC will host their annual Spring Hamfest and Flea Market from 8:30 AM-1:30 PM, (Set-up at 7:30 AM) at the Westway United Church, 8 Templar Dr. Talk-in on 146.985/R or direct 146.52. Reserve early for best tables. Contact *John Wilson VE3WIL, (416) 663-0178*; or *Rex Sweetapple VE3XER, (416) 663-0288.*

MAY 14-15

FT. WAYNE, IN The Ft. Wayne Computer Fair, sponsored by Trade Show Productions, Inc., will be held from 10 AM-5 PM at the Memorial Coliseum. Flea Market. Demonstrations. To reserve space, make checks payable to *Trade Show Productions, Inc.*, and return to: *Mark Hanslip, 143 Schloss Ln., Dayton OH 45418.*

SELAH, WA The Yakima ARC will hold their annual Hamfest at Selah Middle School. Seminars. VE Exams. Breakfast, lunch, and banquet. Talk-in on 146.660. Contact *Dick Umberger N7HHU, (509) 248-3580.*

MAY 15

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Tailgate Electronics/Computer/Amateur Radio Flea Market from 9 AM-2 PM at the corner of Albany and Main. For reservations and info, call *(617) 253-3776*. Mail advance reservations before May 5th to *W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139*. Talk-in on 146.52 and 449.725/444.725 - pl 2A - W1XM/R.

HOLLY, MI The 4th annual ARRL sanctioned Hamfest/Computerfest, sponsored by the Fenton Area ARA and the Ben Sherman Middle School ARC, will be held

at Ben Sherman Middle School. Hamfest 8 AM-2 PM (Set-up 6 AM-8 AM). Talk-in on 146.780 (-600) and 442.250 (+5 MHz) linked Rptrs. Contact *FAARA, P.O. Box 46, Fenton MI 48430*.

WAUSEON, OH The North-West Ohio Tri-County HAMFEST will be held at the Fulton Co. Fairgrounds on State RTE 108 (Ohio Turnpike Exit 3). Flea Market. VE Exams by appointment only; Contact *Tom Hay (419) 542-6192*, before May 8th. Talk-in on 147.195+ K8BXQ Rptr. Phone *(419) 264-7775* lor table reservations or into; SASE to *Mike Sharpe N8RLD, 126 Muntz St., Holgate OH 43527*.

WHEELING, WV Triple States RAC, Inc. will present their 17th annual Wheeling Hamfest-Computer Show at Wheeling Park, from 8 AM-3 PM. Antique Car Display. 1912 Beechy Plane replica on display. Talk-in on 146.91. Contact *TSRAC, Box 240, RR 1, Adena OH 43901. Tel/Fax (614) 546-3930*.

MAY 20-22

ROCHESTER, NY The 60th annual Rochester Hamfest and Computer Show, combined with the Atlantic Div./New York State ARRL Convention, will be held at Monroe County Fairgrounds, Route 15A & Calkins Rd. Sponsored by the Rochester ARA. The Flea Market will run continuously lor the entire weekend, starting at noon, Fri. May 20th. For info, call *(716) 424-7184 during weekday business hours*. For a brochure, write to *Rochester Hamfest, 300 White Spruce Blvd., Rochester NY 14623*.

MAY 21

COLORADO SPRINGS The Pikes Peak RAA will hold a Ham Radio Swapfest from 8 AM-3 PM at Liberty H.S., 8720 Scarborough Dr. Ham gear. Computers. Electronics. Talk-in on 146.97/.52. Swapfest Contact: *Harv Hunter WA3EIB, (719) 597-8964*. VE Exams begin at 9 AM; contact *Rick Brown KD0SU, (719) 531-9423*. Send pre-registration checks payable to *PPRAA*, with SASE to *John Kramer N0VBM, 1765 Kimberly Place, Colorado Springs CO 80915. Tel. (719) 550-1489 after 5 PM*.

EPHRATA, PA The 9th annual Ephrata Hamfest-Flea Market will be held by the Ephrata Area Repeater Soc., Inc. at the Ephrata H.S., 803 Oak Blvd. Their Radio/Computer/Electronic Flea Market will start at 8 AM (Set-up at 6:30 AM). VE Exams will begin at 9 AM. Make checks for $5.75 payable to "ARRL/VEC." Bring original and a photocpy of your current license, and 2 forms of ID. Flea Market Pre-registrations deadline is May 10th. No refunds. Make checks or money orders payable to *Ephrata Area Repeater Soc., Inc., 906 Clearview Ave., Ephrata PA 17522. Tel. (717) 336-2514 (after 6 PM)*.

FORESTDALE, RI The Rhode Island Amateur FM Rptr. Service, Inc., will hold their annual Spring Auction and Flea Market at VFW Post 6342, Main St., Forestdale (No. Smithfield). The Flea Market opens at 8 AM, with the Auction beginning at 11 AM and continuing until about 3 PM. Talk-in on 146.76. Contact *Rick Fairweather K1KYI, 106 Chaplin St., Pawtucket RI 02861*; or call *(401) 725-7507 between 7 and 8 PM*.

MINNEAPOLIS/ST. PAUL, MN A Tailgate Swapfest will be held by the TwinsLAN ARC, at Honeywell Ridgway facility parking lot, 2600 Ridgway Pkwy. Open to the public 7 AM-1 PM (Set-up at 6:30 AM). Talk-in on 146.76/.16 K0HB Rptr. Contact *Bill Brisley N0BSN, 18025 Cynthia Dr., Minnetonka MN 55345-4206. Tel. (612) 474-0118*.

PADUCAH, KY The Paducah ARA will sponsor an ARRL Hamfest lrom 8 AM-2 PM (Set-up at 6:30 AM), at Noble Park Civic Center. Flea Market. VE Exams. Concessions. Other goodies available. Contacts: *David Fraser KQ4IU, 5715 Blandville Rd., Paducah KY 42001, (502) 554-7999*, or *Paul Smith N4FFO, 229 Nickello Hts., Paducah KY 42001, (502) 898-6834; packet address @W4NJA.WKY.KY.USA.NA*.

PHILLIPSBURG, NJ The Cherryville Hamfest, sponsored by the Cherryville Rptr. Assn. II Inc., will be held lrom 8 AM-2 PM at the Warren County Farmers Fairgrounds. Set-up at 6 AM. Flea Market Contact: *Keith Burt KF5FK, (908) 788-4080*. VE Exams Contact: *Marty Crozinski NS2K, (908) 806-6944*. Talk-in on 147.375+ and 146.820-.

SACRAMENTO, CA Visit the Carmichael Elks Lodge in Carmichael, between 8 AM-3 PM, to enjoy the annual Hamswap sponsored by the North Hills Radio Club. Talk-in on 145.190- (K6IS). For details, write lo *NHRC, P.O. Box 41653, Sacramento CA 95814-0635*.

MAY 22

CANFIELD, OH The Canfield OH Fairgrounds on RT 46 will be the location for the 10th annual Hamfest/Computer Show sponsored by the Twenty Over Nine Radio Club. Doors open 8 AM-3 PM. (Set-up starts at 6:30 AM). For info, contact *Don Stoddard N8LNE, 42 S. Whitney Ave., Youngstown OH 44509, (216) 793-7072*, or *Dave Mellott KE8KT, 2895 Penny Ln., Austintown OH 44515, (216) 793-0816*. Advance registrations must be received by May 15th; send with SASE to *20/9 ARC Inc., 42 S. Whitney Ave., Youngstown OH 44509*. Talk-in (before 1 PM) on 147.315+, 443.225+, or 224.160 MHz simplex.

PLAINEDGE, NY The Suffolk County RC and the Great South Bay RC will hold their Long Island Hamfest/Computer Show from 9 AM-4 PM at the Plainedge H.S., Wyngate Dr. Talk-in on 146.685 and 223.86. Contact *Andy Feldman WB2FXN, (516) 928-3868 (eves. 7-10 PM)*; or *Walt Wenzel KA2RGI, (516) 957-5726*.

MAY 28

COLUMBIA, MO The Central Missouri Radio Assn. will hold their 19th annual Hamfest/Computer Expo from 8 AM-4 PM at the Hearns Multi-Purpose Bldg. on Stadium Blvd. Contact *W. "Mac" McKenzie, Jr. K4CHS, (314) 882-7413 days; (314) 442-7619 eves*.

SPRINGHILL, LA The Springhill and Ark-La ARCs will co-host the North Louisiana/South Arkansas Hamfest at Springhill Civic Center. Flea Market. Forums. Commercial Dealers. Contact *David Smith KF5BF, P.O. Box 812, Springhill LA 71075. Tel. (318) 539-3226*. Talk-in on 146.73 and 147.39.

MAY 29

SOREL, QUEBEC, CANADA The Club Radio-Amateur Sorel-Tracy will hold their "Hamfest du Quebec" at The Curling Club. For details, write to *Club Radio-Amateur Sorel-Tracy, C.P. 533, Sorel, Quebec, Canada J3P 5N6*.

MAY 30

SYLACAUGA, AL The 3rd annual Talladega RAC Hamfest will be held at J. Craig Smith Comm. Center beginning at 8 AM. VE Exams at 8 AM sharp, with walk-ins accepted. Forums. Contact *Jim KD4BHH, (205) 245-7825.*

JUNE 4

KITCHENER, ONT., CANADA The 20th Central Ontario Amateur Radio Fleamarket will be held at Bingeman Park. Contact *Jack Knight VE3RGY, 35 Brockville Ave., Guelph, Ont. Canada N1E 5X5. Tel. (519) 823-1358.*

KNOXVILLE, TN A Hamfest will be held from 8 AM-4 PM at Tennessee Valley Fair Grounds-Chilhowee Pk. Sponsor: RAC of Knoxville. VE Exams. Talk-in on 147.30+ RACK Rptr., and 224.50+. Dealers contact *Angela Crigger N4RPR, 2707 Pine Hill Dr., Knoxville TN 37938. Tel. (615) 694-9071.* For info, contact *Ross A. Ramsey KC4YDR, 790 N. Cedar Bluff Rd., Knoxville TN 37923. Tel. (615) 690-1520.*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. in Teaneck. Pre-registration required for Flea Market spaces w/power; Contact *Jim Joyce K2ZO, (201) 664-6725.* VE Exams; contact *BARA VE Hotline, (201) 797-0151 before 10 PM.* Talk-in on 146.190/.790; 145.620 simplex.

JUNE 5

EVANSVILLE, IN The Tri-State ARS will hold their 47th Hamfest/Electronic/Computer Show at the Vanderburgh County 4H Center, Boonville-New Harmony Rd, starting at 8 AM (Set-up at 7 AM). Talk-in on 147.15/146.79. Contact: *Charlie Apfelstadt N9GWS, TARS, P.O. Box 4521, Evansville IN 47724. Tel. (812) 477-7716.*

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Talk-in on 146.355/.955. For details, contact *Bruce Burton KU9A, or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.*

SALINA, KS The Central Kansas ARC will sponsor its annual Hamfest 8 AM-3 PM, in the 4H Bldg. in Kenwood Park. Flea Market. Commercial Booths. Contact *Larry White KB0BH, 336 Sunset Dr., Salina KS 67401. Tel. (913) 827-3737.*

SPECIAL EVENT STATIONS

APR 29-MAY 1

MOJAVE DESERT, CA Billy Holcomb Chapter of E Clampus Vitus will operate KC6LUC to commemorate Fort Cady. Operations will be in the phone portions of the General 80, 40, 20 and 15 meter subbands, and in the Novice 10 meter subband. For a certificate, send QSL and 9"x11" SASE to *KC6LUC, Sid Blumner, 1458 Albright Ave., Upland CA 91786-2722.*

APR 30

SONOMA VALLEY, CA The Valley of the Moon ARC, WB6DWY, will operate in commemoration of the City of Sonoma and the Valley of the Moon's rich historical heritage, from 1700 UTC-2400 UTC. The station will be operated during the club's annual Hamfest. Listen throughout the day on the General phone portions of 10, 20 and 40m. For a nice parchment certificate, OSL with SASE to *VOMARC, 358 Patten St., Sonoma CA 95476.*

APR 30-MAY 1

PHILADELPHIA, PA The Olympia ARC will operate WA3BAT from 1300Z April 30th-2000Z May 1st, to commemorate the 96th Anniversary of Admiral Dewey's triumph over the Spanish Fleet at the Battle of Manilla Bay. SSB/Phone—3.898, 7.268, 14.268, 21.368, 28.368, 145.270, and packet. For a certificate, send QSL and a 9"x12" SASE to *Olympia ARC, P.O. Box 928, Philadelphia PA 19105.*

MAY 1

WAMEGO, KS The Mahar ARC will operate KB0GPR 1400Z to 2000Z to celebrate the annual Mahar Family Reunion. Operation will be in the 20 and 40 meter General phone bands, 146.580 and 28.350. For a certificate, send QSL and business size SASE to *Mitch Anderson KB0GPR, P.O. Box 931, New Strawn KS 66839-0931.*

MAY 4-14

HOLLAND, MI The Holland ARC will operate a Special Event Station to celebrate Tulip Time. Operation will be in the lower portion of the General 20 and 15 meters and 28.400 MHz. For a certificate, send QSL with call signs worked, and a 9"x12" SASE to *N8NXA, Barbara Siebelink, 6418 Otis Rd., Saugatuck MI 49453.*

MAY 6-8

ABERDEEN WA The Grays Harbor ARC will operate W7ZA from 2300Z May 6th-2300Z May 8th, to celebrate their 40th Birthday. CW operation will be in the Novice portion of the 10, 15, 20, 40, and 80 meter subbands, as well as in the General portion of the 20 meter band. SSB will be in the General portion of the 10, 15, 20, 40, and 80 meter subbands and the 10 meter Novice band. For a QSL card, send QSL and SASE to *GHARC, P.O. Box 2250, Aberdeen WA 98520.*

MAY 7

DEKALB, IL The Kishwaukee ARC will operate WA9CJN 1600Z-2200Z to help celebrate the Three Fires Council BSA Scout-O-Rama show. The purpose is to encourage young men and boys to gain an interest in ham radio and earn the Radio Merit Badge. For a certificate, send an SASE to *KARC, WA9CJN, P.O. Box 264, Sycamore IL 60178, ATTN: KB9AGV.* Listen for WA9CJN on 28.430 +/- QRM.

MAY 9-14

VAN ALSTYNE, TX Amateur Astronomers/Hams representing the Southwest Region of the Astronomical League will be operating SE Station K5GH (K 5 Galaxy Hunters) at the 13th annual Texas Star Party. The TSP is located near the Univ. of Texas's McDonald Observatory in the Davis Mountains of West Texas. Operation will be (+/- QRM): 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical theme QSL card, send QSL/SWL report and SASE to *K5GH-TSP, 2619 Bordeaux, McKinney TX 75070.*

MAY 10

PROMONTORY, UT The Ogden ARC will operate W7STB 0001Z-2100Z, to commemorate the driving of the Golden Spike at Promontory Summit. Frequencies: 3.970, 7.270, 14.280, 21.375, and 28.415 MHz. Send QSL and SASE to *Ogden ARC, P.O. Box 3353, Ogden UT 84409.*

MAY 13-15

SAN ANTONIO, TX The San Antonio RC will celebrate its Diamond Anniversary by operating W5SC from 2200Z May 13th-2200Z May 15th. Operation will be in the bottom 50 kHz of the General phone bands on 75-10 meters (Novice/Tech part of band on 10). For an 8 1/2"x11" certificate and QSL, send SASE and QSL to *"SARC Diamond Jubilee," 10227 Mt. Crosby, San Antonio TX 78251.*

MAY 14-15

BROKEN ARROW, OK The Broken Arrow ARC will operate AB5EE from 1500 UTC May 14-0300 UTC May 15 in conjunction with the Broken Arrow Chamber of Commerce sponsored "Rooster Day." Frequencies: 10m Novice band, along with all HF bands in CW and SSB. Also on VHF FM. For a certificate, send QSL and 9"x12" SASE to *Broken Arrow ARC, Box 552, Broken Arrow OK 74013.*

CARLISLE, PA The Cumberland ARC will operate K3IEC 1300Z-0100Z May 14th and 15th, to celebrate the Club's 30th Anniversary. Operation will be phone and CW on the 160-6 meter bands. For QSL, send QSL and SASE to *CARC, 107 Hilltop Rd., Boiling Springs PA 17007.*

MAY 15-JUNE 15

WAIANAE, HI To commemorate the beautification of Father Damien, Hawaiian hams will operate a variety of Special Event stations. Activities are planned for all bands, all modes, including the Novice subbands. Operations begin on May 15th, to coincide with the official ceremony in Belgium, and will continue until June 15th. For a QSL, please send your card, SASE, and name of operator worked to *AH6KY, Apt. #608, 84-265 Farrington Hwy., Waianae HI 96792; or directly to the operator contacted.*

MAY 20-22

HAINES FALLS, NY The Long Island Mobile ARC's Junior Operators Committee will operate K2YEW from their QRP Camping Weekend at North Lake State Park in Greene Co. Frequencies: 3.560, 7040, 14060. QSL to *Robert Todaro N2JIX, 2218 E. 73rd St., Brooklyn NY 11234.*

MAY 21

PASADENA, MD The Bay Area ARS, in cooperation with the Anne Arundell County Historical Soc., will operate Station KM3I to commemorate the 150th Anniversary of the telegraph message "What Hath God Wrought," transmitted on an experimental line from Washington DC to Baltimore MD. Operation will be 1300 UTC-2000 UTC on one or more of the following CW frequencies: 7.125, 14.125, 21.125, 21.225, 28.125 MHz. For a commemorative certificate, Amateurs send your QSL card; SWLs send details of the QSO, along with an 8 1/2"x11" SASE, to *Greg Ocfemia, Bay Area ARS, 419 Brooks Ct., Glen Burnie MD 21061.*

SEATTLE, WA The 2nd Annual NorthWest QRP Club Spring Sprint Contest will be held from 1700 UTC-2100 UTC. Frequencies: 7035-40, 14055-60, 21060 kHz. Logs must be received by June 15th, 1994 by: *Stan Yarema KG7ME, Contest Editor, 3457 12th West, Seattle WA 98119.*

MAY 21-22

HANSKA, MN The New Ulm ARC will operate KB0IWV 1600Z-0400Z May 21st, and 1600Z-2300Z May 22nd, to celebrate Hanska's 10th annual Syttende Mai. This is to commemorate the 180th Anniversary of the enactment of the Constitution of Norway. Frequencies: 7.250, 14.250 MHz, and the Club Rptr. at 147.33+. For a certificate, send a QSL and a 9"x12" SASE with 2 First Class stamps, or a #10 SASE (for a folded certificate) to *New Ulm ARC, KB0IWV - Patrick Mathiowetz, RR 4 Box 14-A, New Ulm MN 56073.* SWL reports welcome.

ST. CHARLES, MO The St. Charles ARC will operate WB0HSI 1300Z-2100Z as part of the Lewis and Clark Rendezvous, to commemorate the departure of the Lewis and Clark Expedition on 21 May 1804. Frequencies: 7.265, 14.265, 21.365, 28.465, 146.67, AO-13 Modes B and J, as propagation and QRM permit. For a certificate, send a 9"x12" SASE to *St. Charles ARC, P.O. Box 1429, St. Charles MO 6332-1429.*

MAY 21-23

OAK PARK, MI The Oak Park ARC will host the 1994 Michigan QSO Party, 1800Z May 21st-0300Z May 22nd; and from 1100Z May 22nd-0200Z May 23rd. Frequencies: CW-1810, 3540, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125. Phone-1855, 3905, 7280, 14280, 21380, 28580. VHF-50.125, 145.025, 146.52. Results will be final on July 30th, 1994 and will be mailed to all entrants who have sent in an SASE. Mailing deadline is July 1st. Send logs to: *Mark Shaw K8ED, 27600 Franklin Rd., Apt. 516, Southfield MI 48034.*

MAY 28-29

BELLEVUE, NE The Bellevue ARC will operate W0WYV from the Strategic Air Command Museum, adjacent to Offutt Air Force Base, 1300Z-2200Z on May 28th and May 29th. Operation will be in the lower phone portion of the General 40, 20 and 15 meter bands, and if propagation permits, in the Novice portion of the 10 meter phone subband. For a QSL, send QSL card with contact number and a #10 SASE to *N4OWG, 1311 Greenwood Ave., Omaha NE 68133-2526.*

NORTH SYRACUSE, NY The Liverpool Amateur Rptr. Club will operate WA2ISC from 2000Z May 28th-2200Z May 29th, to commemorate the Mid-Empire State Chapter 293 Vietnam Veterans of America's WatchFire VII Memorial Day fire lighting. SSB operation will be in the vicinity of 7.240 and 14.240. CW operation will be in the lower 25 kHz of 40m and 20m general sub-bands. RTTY on 40m and 20m. Other bands as conditions permit. For a certificate, send QSL and 9"x12" SASE to *LARC, P.O. Box 103, North Syracuse NY 13212.*

MAY 30

ELGIN, IL Station W9IKN, sponsored by the Elgin ARS in conjunction with the annual running of the Valley Fox Trot 10-mile race, will be on the air from 1200Z-1700Z. Operation will be in the lower portion of the General subbands on SSB and CW, and propagation permitting, 50.200 SSB. For a certificate, send business size SASE to *E.A.R.S., P.O. Box 1351, Elgin IL 60123-1351.* 73

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PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

This month's calendar shows few Good (G) days for propagation, while the remainder are Fair (F) to Poor (P) and trending from one to the other. DX success this month will require a good receiver and a lot of work. On the Good days you will find conditions favorable for DX, whereas on the Poor days you may hear few DX stations, and those are likely to be on the north-south path across the equator. The Fair days are the ones where opportunity will present itself but will require effort, with signals fading in and out and general instability on all bands. As usual, when conditions are marginal, the higher HF bands tend to be affected the most. Anticipated conditions by band are as follows:

10-12 Meters

Some north-south openings during afternoon hours. On some days you will find sporadic E that can provide signal paths of short duration to 1,000 miles or so.

15-17 Meters

On good days you will have fairly good openings to the southern hemisphere during daylight hours, peaking in the afternoon. There will be occasional openings to Europe and Africa on east-west paths, also during the local afternoon. There will be plenty of short-skip and sporadic E skip on many days, out to 1,000-1,500 miles.

20 Meters

The best band for worldwide propagation during daylight hours. This band ought to open shortly after sunrise and remain open until after dark. Peak conditions should occur an hour or two after sunrise and again in the late afternoon. Short-skip will be favorable during the daylight hours beyond about 500 miles.

30-40 Meters

Evening, nighttime and sunrise hours are best on these bands for DX contacts. From sunset to midnight toward Europe and Africa, and generally toward the East. During sunrise and for a half hour or so on either side, look for DX to the West and Pacific areas. Daytime short skip to about 1,000 miles, and nighttime skip out to 2,000 miles will occur. Increasing static levels will be present, and may sometimes prevent hearing all but the strongest signals on these bands.

80-180 Meters

No DX openings during daylight hours on these bands. After dark on some days you may find DX (limited by QRN), and again around sunrise. Short skip of 200 miles or so may be available on 80 meters, and distances out to 2,000 miles or so at night. On 160 meters, skip out to about 1,000 miles should be available when QRN is absent.

Special Conditions

There may be some severe weather or other geophysical disturbances surrounding the dates of May 16th and 27th, and lasting for a day or two. Keep your ear open for WWV on 5, 10, 15, and 20 MHz at 18 minutes after each hour for latest propagation news.

There will be a partial lunar eclipse on May 25th, visible in most of both hemispheres. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	20						15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40	40		20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WESTCOAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	30				15
CANAL ZONE	20	20	20	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R.								30	20			

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20	20				15
PHILIPPINES	15							40		20		
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

MAY 1994

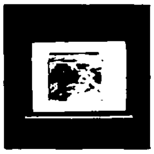
SUN	MON	TUE	WED	THU	FRI	SAT
1 P-F	2 F-G	3 G-F	4 F	5 F-G	6 G	7 G-F
8 F	9 F-G	10 G	11 G	12 G	13 G-F	14 F-P
15 F-P	16 F-P	17 F-P	18 P	19 P	20 P	21 P
22 P-F	23 F-G	24 G	25 G-F	26 F-P	27 P	28 P
29 P-F	30 F	31 F-G				

Number 29 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

AEA



Advanced Electronic Applications, Inc. is proud to introduce AEA WeFax 256—a new software accessory for users of their DSP-2232/1232 multimode controllers. AEA WeFax 256 is a Windows program for reception and display of gray scale WeFax images.

AEA WeFax 256 displays, in real time, true gray scale images from either the NOAA HF WeFax Service or the NOAA APT Satellite Service. It will provide two modes of resolution—500 or 250 pixels per line—which ensures that the AEA WeFax 256 imaging system will work on your setup. This product incorporates a scrollable receive buffer capable of operating in stop or loop modes.

AEA WeFax 256 comes complete with an image processor. It will support BMP, GIF, PCX, TIF, and JPG image formats. It integrates an Auto Clock function to "wake up" your system; and captures unattended transmissions.

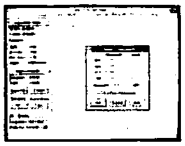
The suggested retail price for the AEA WeFax 256 is $129. AEA WeFax is available from your favorite amateur radio dealer. For more information, please contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554; FAX (206) 775-2340.* Or circle Reader Service No. 201.

NUMBER ONE SYSTEMS LTD.

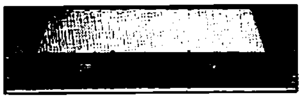
The paper Smith chart, invented over 50 years ago, provides a graphical method for solving impedance matching and transmission line problems. Now, Number One Systems' new Z-MATCH for Windows program greatly enhances the usefulness and accuracy of Smith chart techniques, and adds a wide range of valuable Radio Frequency Engineering utilities.

Z-MATCH for Windows provides RF and Communications designers with a comprehensive set of circuit and system design tools in a remarkably easy-to-use, low-cost package. An immediately apparent advantage of Z-MATCH for Windows is that it works directly with actual lengths of transmission line and actual resistance and reactance values, eliminating the need for normalization. The designer can also switch instantly between impedance and admittance charts.

Z-MATCH for Windows also provides a receiver and system design tool for calculating overall values of gain, noise figure and more. For RF amplifier designers, Z-MATCH for Windows' ability to work directly with S-Parameters greatly simplifies many design tasks. Options include plotting stability circles, the calculation of stability factor, transducer gain, maximum available gain and the source and load impedances needed to achieve it, and even the determination of the component values to provide source and load matches for specified Q.



The program comes complete with a comprehensive instruction manual covering both the theory and practice of using Smith chart techniques and includes many case examples. Z-MATCH for Windows requires a minimum of an AT286 running Microsoft Windows 3.0 or later, and is available direct. The price is $375. For more information contact *Number One Systems Ltd., Harding Way, St. Ives Huntingdon, Cambs. PE17 4WR England; +44 480 461778; FAX +44 480 494042.* Or circle reader Service No. 204.



S-COM INDUSTRIES

S-COM Industries is now shipping a powerful new software upgrade with all 6K Repeater Controllers, which includes a 100-setpoint scheduler to execute tasks at programmed times and dates. Uses include changing the repeater's access mode based on day and night; generating special identifier messages for holidays or special events; announcing nets; charging batteries; weekly pager tests; and so on.

The 6K Repeater Controller with Autopatch is priced at $395. Older 6K controllers may be upgraded with a 6K V2.0 Kit for $49.95 plus $3 for shipping and handling.

For more information, contact *S-COM Industries, P.O. Box 1718, Loveland, CO 80539-1718; (303) 663-6000.* Or circle Reader Service No. 202.

TECHSONIC

A new line of attractive, sturdy QRP transmitter kits is now available for 20, 30, and 40 meters from TechSonic. These professionally engineered 3-watt rigs feature low current drain for long battery life and clean, chirp-free DC keying with low harmonic content.

Output levels on these rigs are adjustable from under 100 mW to 3 watts by changing input voltage; i.e. a 9-volt transistor battery will run all weekend and provide one-half watt out. Twelve volts gets you one watt out, and 16 to 18 VDC delivers 3 watts. The output transistor is fully SWR protected. An RX antenna jack couples to your receiver for single-antenna convenience and full QSK.

Frequency control is via VXO and provides 7 to 14 kHz coverage depending on the band. A QRP frequency crystal is included with each unit. Kits come complete with PC board, all components, connectors, and thorough instructions for easy assembly. All coils are pre-wound. Information on QRP operating, clubs, and awards is also included.

For more information contact *TechSonic, 1642 Butler Pike Suite 127C, Conshohocken, PA 19428; (610) 834-1978.* Or circle Reader Service No. 203.

RF INDUSTRIES

RF Industries' new 28-page catalog presents an expanded range of SMA connectors. These connectors are designed to offer reliable broadband performance from DC to 18 GHz at a consistent 50 ohm impedance. They feature high mechanical strength, high durability and low VSWR.

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For your free copy, call or write *RF Industries, Ltd., 7620 Miramar Road, San Diego, CA 92126-4202; (619) 549-6340; FAX (619) 549-6345.* Or circle Reader Service No. 205.

CONTACT EAST, INC.

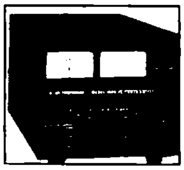
The new 1994 catalog from Contact East is 244 pages of new test instruments and tools for engineers, managers, technicians, and hobbyists. Featured are quality products from brand-name manufacturers for testing, repairing, and assembling electronic equipment. Product highlights include new: DMMs and accessories, soldering tools, custom tool kits, EPROM programmers, power supplies, ELF meters, helpful reference books, breadboards, scopes, meters, datacom tools and testers, adhesives, measuring tools, precision hand tools, and portable and bench top digital storage scopes.

Also included are Contact East's popular lines of communication test equipment, soldering/desoldering systems, static protection products, ozone safe cleaners, magnifiers, inspection equipment, workbenches, cases and more. All products are fully guaranteed, and orders placed by 4 p.m. are shipped by 5 p.m. To receive your free copy, call or write *Contact East, 335 Willow Street, No. Andover, MA 01845; (508) 682-2000; FAX (508) 688-7829.* Or circle Reader Service No. 207.

B+K PRECISION

B+K's new high current variable 3-14 VDC power supply is designed expressly as a substitute for an auto or truck battery. Model 1688 produces nominally 25A maximum at 13.8 VDC continuously, hour after hour, without overheating. (Maximum current output is lower at lower voltages).

Model 1688 is ideal for servicing or demonstrating mobile electronics equipment, such as ham radios. It is a preferred substitute for heavy vehicle batteries that leak acid, must be recharged, and cannot tolerate shorted loads; and for typical high-current DC power supplies that are either high priced or designed for intermittent duty only.



Voltage can be varied from 3 to 14 VDC. Current and voltage can be monitored simultaneously on separate analog meters. Outputs are fully isolated. Line and load regulation are tight (+ or - 0.8%) and ripple is low (less than 10mVrms). Two or more supplies can be connected in series or parallel to double the voltage or current output. And to withstand accidental abuse, Model 1688 has reverse polarity protection, overload protection, short circuit protection, thermal protection, and current limiting.

Model 1688 is priced at $299. For more information or for the name of your nearest distributor, contact *B+K Precision, 6470 W. Cortland St., Chicago, IL 60635; (312) 889-1448.* Or circle Reader Service No. 206.

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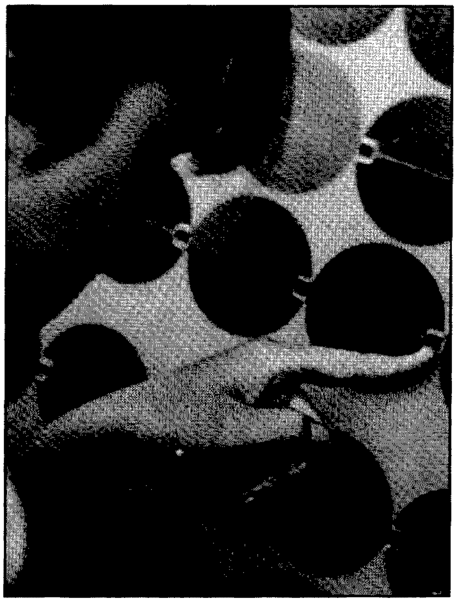

Let's see now . . . How are my solar panels doing? Look on page 18 to find out.

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On the cover: Solar power can be easy and inexpensive if you know what you're doing. See page 10. Photo by Donald Koehler N7MGT; solar cell photo by Mike Bryce WB8VGE.

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Wayne Green W2NSD/1

Reinventing Hamfests

Business has been busy re-engineering itself . . . coming to grips with the revolution in communications and computers. In 1980 almost 99% of all computing power was controlled by million-dollar mainframe and hundred-thousand-dollar minicomputers sitting in special temperature- and humidity-controlled rooms, and operated by white-smocked specialists. Today 99% of the computing power is handled by microcomputers sitting on desks.

Machines are numerically controlled by computers instead of skilled machinists. Middle-management layers have been eliminated. Our stores use bar codes at the checkout to calculate the bill, keep track of inventory, and reorder from the warehouse. Any business that doesn't make the best use of new technologies quickly finds itself irrelevant.

Even government is beginning to go through a time of re-engineering. The old layers of bureaucrats are gradually being replaced by computers and communications systems.

So what hasn't changed? I attended my first ham convention in 1938 and, other than the vintage of the equipment on display (the Hallicrafters Skyrider Diversity receiver was the big deal at the time), absolutely nothing has changed.

Oh, the big hamfests have gotten bigger and most of the small ones have disappeared. The exhibits are the same. The lectures are the same. The flea markets are the same. We only had around 40,000 hams in 1938, so the hamfests were smaller. But not as much smaller as you might think . . . because almost every ham in the area turned out for the hamfests in those days. Today, with over half our licensed hams completely inactive, and half of what's left only marginally active, many of the hamfests are about the same size as they were over 50 years ago. Today a hamfest is doing very well if it attracts 5-6% of the amateurs in the area.

Of course in those days we had CW and phone. Period. Well, yes, there were a few VHF pioneers way up there on 10 meters. The first ham I ever visited, Harry Stevenson W1CUN, was one of the 10m pioneers back in the mid-1930s. My grandfather took me to visit Harry's hamshack in 1934 and I was impressed. Very impressed. His "shack" was set up in a small storage building out behind the Valley View Inn in Bethlehem, NH, where his mother, Mamie, was the pastry chef.

My grandparents picked the town as a summer refuge from hay fever for my grandmother. They, and my mother, who was 20 at the time, spent their first summer at the Inn and got to be good friends with the owner, Johnny Macauley, and Mamie. They liked Bethlehem so much they bought an old farm with a cottage, where they spent their summers from then on.

It didn't take long before Sanger Green, from Littleton, the next town over, was dating my mother. That led to marriage and, eventually, me. And I spent my summers with my grandparents on the farm up until WWII.

When I saw the hamshack and watched Harry sitting there talking with hams all around New England, that was the first bite of the apple of wisdom. Wow! So I started playing with electricity and learning. I never would have guessed that in 1946, soon after I was discharged from the Navy, I'd have my own ham station set up in the same building that Harry used a few years earlier, sitting there working DX on 20m phone, and talking with hams all around the East Coast on 75m. Well, you see, the farm, as we called it, had no electricity. Heck, it had no water either, just a spring up on the hill with a pipe which my grandfather had put in, running into a big jar in the cellar. From there we pumped the spring water into the sink with a hand pump.

The toilet was a stinky backhouse out behind the barn and you got your feet wet in the dewy grass walking out there in the morning, and had to take along a flashlight at night. My first chore when I got up was to start the fire in the kitchen stove. Wood fire, using some newspaper, kindling, and a little kerosine. Then, when the water tank on the end of the stove was warm, I'd dip out about five gallons of warm water into a sprinkling can and hoist it with a rope for my morning shower. This was out in the woodshed, where it got cold at night, even in mid-summer. The shower water just ran through cracks in the floor boards and into the dirt under the shed.

We did have a telephone. It was a crank type and we were on a party line, ring three.

Lacking any electricity, I borrowed Harry's old shack to set up my ham gear during the summer of 1946. I'd just spent four years in the Navy and was going back to college in the fall, so sitting on a hillside in northern New Hampshire hamming seemed like a great way to spend my summer. I packed my Hallicrafters SX-28 receiver and my homemade pp 813 kilowatt all-band AM rig into my old 1939 Ford, drove it to Bethlehem, and was in business.

Hamfests 1994

With the recent apparent collapse of the much-touted *CQ* magazine commercial hamfests, which were, as usual, patterned on the 1930s style, and the winding down of interest in many other regular hamfests and conventions, perhaps it's almost time to consider what the hams of 1994 want, rather than what the hams of 1934 wanted.

In those days there was a small contingent on 160m phone, mostly using a 6L6 crystal oscillator modulated by another 6L6, and almost everyone else was on 40m CW. All the hams pretty much knew everyone else in their area, so meeting each other in person at a hamfest was fun. It was like a small fraternity.

As I've explained, the steadily increasing exhibit costs at Dayton forced the *73* staff to rethink their policy of exhibiting, which I first started in 1955, when I became the editor of *CQ*. Many industry people have been taking a closer look at the rising costs of booth space and the sales resulting from hamfest exhibiting . . . and staying away. They've found there are far less costly ways to generate sales.

The parking situation at Dayton is horrendous, with long walks for almost everyone. Then, when it rains, you can be in mud up to here. And it has tended to rain. The thousands of cars fill the open fields around the Arena, making an impressive picture from the air. But I sure wish they'd come up with a better location for their hamfest.

One of the reasons Dayton draws such a big crowd is that it's centrally located in the country and provides a practical way for hams with special interests to get together. The weather satellite picture hams meet. The ATVers meet. The slow-scanners meet. And so on.

So why not take advantage of this and refocus hamfests as platforms for interesting newcomers in these ham special interests? The slow-scan group could be encouraged to set up exhibits demonstrating what they are doing and how to get started. They could put together some videos to help their exhibits. All the other ham special interests could be represented by the ham industry companies supporting their interest, plus any clubs and outstanding hams involved with that interest.

Would you like to see all the packet groups together, complete with videos and demonstrations? Ditto the ATVers, complete with videos of their balloon video trips. And so on down the list of sub-hobbies which go to make up amateur radio.

What's new in RTTY? In high-speed CW? In 10 GHz pioneering? In AMTOR? In Clover? In QRP? How about certificate hunting? Any chance of code-copying contests with certificates of merit for different speeds? Transmitter hunting gear? 160m DXing? 75m phone DXing?

Could we start using hamfests as a way to attract newcomers? If we invited interested school kids to come, and we had exhibits which explained how repeaters work, ham satellites, and so on, we might start seeing some interest from youngsters.

Judging from the downhill slide of interest in hamfests, either the organizers are going to have to reinvent them or bury them. After over 60 years of the same old stuff, it's beginning to smell.

What Would Get You to Come?

My AIDS cure editorial generated one of the biggest stacks of reader mail in years. I enjoyed that, but it isn't enough. Now I want to get you to thinking creatively about hamfests. Yes, I know, you've been through the same 16 years of our American mind-numbing school system I suffered, so you've been punished for most of those years every time you attempted to think or ask questions. It's time to start breaking this pattern and getting what little is left of your atrophied gray matter into gear.

Let me know what ideas you have for hamfests. What could they do that would get you to drive a hundred miles and maybe stay for a day or two?

Think about it. Talk at your ham club meetings. Discuss it on the air. Let's have some ideas on how hamfest organizers can make sure that you'll drive at least a hundred miles to get to the next hamfest in your area. What would it take?

Customer Unservice . . .

One of the lessons successful companies are learning is the importance of customer service. And it's 10 times more important in the ham field, where so many customers are on the air and talking with prospective customers. The

Continued on page 76

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Steve Katz WB2WIK/6, Chatsworth CA I am truly grateful for the wonderful response to my 2 meter amplifier conversion article in the April 1994 issue of *73*. It restores my faith that not all hams are appliance operators and some are still willing to tackle worthy home-brew projects other than simple digital circuits. Within three weeks after publication of this article, I received 89 letters, faxes or cards from fellow amateurs sincerely interested in following the instructions to completion of their own home-brew half-kilowatt VHF amplifier. I've tried to answer every single inquiry as thoroughly as possible, to assist those in need of help to actually complete their projects and get them on the air. Bravo to our readers and fellow home-brew and VHF-UHF weak-signal enthusiasts! Get those amplifiers running and look for me on the "weak signal" modes.

Marcus Ely KB7UIS, Fort Worth TX Thank you for including plans for home-brew radios and equipment in your periodical. I have successfully (finally) built the SP-1 Spider transceiver designed by Mike Agsten WA8TXT, featured in the January 1993 issue. I built it from scratch, in the 30 meter and the 40 meter versions. I am new at home-brewing, but I had a ball, as I learned very much in making these radios. I even etched my own circuit boards.

Mr. Agsten has been very helpful. He has patiently answered my questions by mail. I had some problems, mostly due to my own soldering, or to incompletely etched traces on my home-brew boards. But, each time I wrote to Mr. Agsten he steered me to the part of the board or the component to check, and I found the problem.

Randy Minnick WA6IXI, Longview WA Wayne, I simply *had* to write to say "thanks" for helping me to get off my dead . . . er . . . uh-huh . . . and move towards an upgrade after being a ham for 20 years.

If it weren't for your carping about such matters, I doubt very seriously if I would have given all that much thought to the matter, what with being quite comfortable with my ticket (Advanced) and all. (After all, what are a few extra kHz privileges, anyway?) The fact of the matter was that you were right. I simply had no excuse not to. You actually caused me to choose to be honest with myself or stay in "limbo land" with no direction and "no one at the helm."

Not only have I successfully upgraded to Extra, but my packet station is almost complete now and, though I've been a dedicated HFer for 20 years, I'm now having a great time on VHF. My soldering iron is going to get hot again as I start building QRP equipment after too long a time. There is also a new business opportunity that I'm pursuing that will allow (among other things) a new HF rig.

Having been a reader of *73* since early '73, it was obvious that you are a very rare individual who sees things quite clearly and then, after assessing a situation, does whatever is required to "get the job done." I further saw that you saw *no real reasons* for others to not live up to their fullest potential, not accepting their lame, and usually invalid, excuses.

But what really impressed me was that you strove, and are striving, to motivate others so that they might overcome "themselves" and their self-limiting thinking. There is/was no real "carping," but genuine wit and (really) good-natured bantering proffered, not for destructive and self-righteous criticism, but for the *motivation* that *we*, the too-silent majority of "HAMsters," might start the thinking (and dreaming) that is *required* to overcome the natural inertia that quietly begins to creep upon us as we age and lose the fire and wanderlust that burned so brightly in our breasts as youths (who were *not* afraid, incidentally, to experiment and innovate). I noticed the tidbits that you tossed out to stimulate our thinking and, per adventure, blow off some of the cobwebs we've allowed to collect between our ears ("use it or lose it" *is* a universal law); tidbits that would benefit not only the hobby but the economy (especially the personal economy).

I also have seen your detractors, to which, again, I say "thanks," Wayne, for not giving in to them and letting them steal your dreams and rob you of your gusto for life so that you might continue to positively influence others. Even if no one else has been affected, I have been.

David Mallory N4VW, Spartanburg SC Wayne, I thought you'd appreciate knowing that I just finished a "supper" of beans, corn bread and milk, and I will repeat that for three more meals because of your Intelligent technical sarcasm! No $5 meals out at the diner.

You see, I am an electrical designer (CAD) who is unemployed due to a fifth downsizing. But, the renewal notice you wrote is so right-on-target that I'll gladly sacrifice food for the stomach for the food for the mind that your magazine continues to provide. Your insight is refreshing, yet realistic about our tough technical world. Only the "whiners" miss the true intent of your sarcasm. *You love* this hobby and the people and industries that also love it and feed its growth! You are the catalyst for the "What If?" and "Why not?" thinkers. So OK, you got my renewal price again, but I thank you.

Trevor Davis VE3DKV, Kirkland Lake, Ontario, Canada Wayne, I have a proposal to make and that is to allow all amateurs to operate HF, but only at QRP unless they have Morse code, then they can fully use the TX power that their privileges allow them to use. Amateurs with an Advanced ticket, or whatever is equivalent In the US, should be allowed to use a maximum power of, say 100 watts AM, unless they have their Morse code ticket. I believe this would greatly help in promoting the amateur radio hobby and maybe, with the 10 meter band busy, we can scare off the bootleggers of the band.

Trevor—I've proposed something much like this, but got little reader response. The Japanese do this, limiting no-coders to 10W on all bands . . . Wayne

Allan Feir VE6CGP, Calgary, Alberta, Canada After reading your rantings and ravings for some time, I finally did it. I took out a subscription to *73* so I wouldn't miss any of your editorials. While I don't agree with everything you say, I do agree with most of it, and I find your topics to be very timely.

If you are concerned about lousy government, take notice of what we do in Canada: We turf them and leave their party in shambles. Next, maybe we will think ahead and have a decent alternative ready to be voted in. That, of course, is where we all need to get off our butts and do something.

Philip D. Wilbur N5STW, Dallas TX Wayne, I started reading *73* about a year ago on a regular basis. I don't always agree with everything you say in your editorials, but then who should? At least you make me think about different aspects of a subject.

In response to your February issue, I have checked out a copy of *Cross Currents* and have started reading it. I have also shown your editorial to people at work and at least one individual is planning to purchase the book. I would like to see the design of the two experimental devices for chasing and killing the HIV virus.

My interest is not specifically with AIDS but with viruses in general, especially in the parrot family. Since conventional medical treatment for most viruses is next to nonexistent, other than to treat the symptoms and hope the patient outlives the disease, it is refreshing to find other possible alternatives.

Concerning your March editorial, the information on light hits a little closer to home. My father grew up in Arizona on a farm in the early part of the century. He was exposed to much sunlight for many years. He was also a commercial and military pilot for 40 years. For the last 35 or so years he has fought skin cancer. I have also shown signs of skin damage, but at an older age than when my father's first appeared. I have not chased down Lieberman's book. It will be interesting to see how he explains an alternative to conventional theory about the dangers of ultraviolet radiation. Just as there is evidence to show that hams tend to die at a younger age, there is also evidence to show that people who have spent a lot of time looking at the daytime sky, such as radio control airplane fliers like myself, have more eye problems than the general populace. I don't know if he addresses this issue—it could have drastic consequences if not approached very carefully.

Philip—The closer we live to the conditions in which our species developed, the healthier we should be. Too much of almost anything seems toxic, so perhaps it's that way with light. Ditto too little. We need certain vitamins, but in the quantities our species has adjusted to. We need . . . not too much and not too little.

There are other factors that are beginning to come to light. You've read about the 50% drop in sperm count over the last 50 years, possibly resulting from pesticide pollution. Well, whatever is doing that isn't leaving the other 50% of our sperm in good shape. And what's it doing to the ova? and to other aspects of our bodies, as well as to our children?

We know that nicotine, alcohol and other drugs adversely affect sperm and ova, and we know the effect sure isn't positive. Now we're finding that EMFs also affect sperm, as do magnetic fields, and even gravity. What a mess! Try mating some mice over a positive magnetic terminal, and others over a negative terminal. Try this with seeds! With one polarity you get big, fat, happy dumb mice. With the other you get thin, smaller, smarter mice.

Now, on cancer, perhaps you'll learn more about this if you read Douglass' book, Into The Light, *184ff. Interesting. Cheers . . . Wayne*

Tom Cox KA5NEE, Muncie IN Wayne, thanks for your recommendation of the book *Cross Currents* by Dr. Robert Becker. I was skeptical about the credibility of this book before I read it, but no more. I am a respiratory therapist, a free-lance writer, and a radio amateur, and that combination of viewpoints increased my appreciation of Dr. Becker's expertise and his writing ability.

I was impressed with the weight of scientific data that shows the impact that even very weak EM fields can have on the body. I have never seen this data cited in the mainstream media, which is odd, considering their penchant for lending free publicity to environmental causes that have no scientific basis, such as the greenhouse effect and ozone depletion.

The potential for therapeutic uses of DC and AC fields is truly exciting. Traditional medicine certainly leaves a lot to be desired in the treatment of cancers and chronic lung disease. Any potential advance in these areas needs to be investigated, and any politically-motivated resistance to this research from the government or the scientific establishment is irresponsible.

You mentioned in your editorial that this field is wide open for experimentation by radio amateurs. I hope to see some articles about this topic in future issues, but I can imagine that you'll have some serious legal concerns to work out before any "how-to" or experimental articles can be published. One project I'm anxious to see is a reasonably-priced ELF field-strength meter. Surely that could be done without making any illegal health benefit claims or product liability exposure. I would like to have the means to evaluate the fields in my own environment, as well as the effectiveness of any protective measures I may take. Didn't some reviews of commercially-available ELF field-strength meters appear in *73*? As I recall, they were either expensive or unreliable, or both. Surely we can do better.

Keep poking your stick into the hornets' nest, Wayne. My next purchase is *Light, Medicine of the Future.*

Tom—Watch for the AcuGauss unit! . . . Wayne

QRX . . .

Number 3 on your Feedback card

Cold Fusion is Hot

If you aren't finding enough challenges in ham radio, perhaps you'd like to dabble in a growing technology that could very well make you rich. The water-fuel phenomenon called *Cold Fusion* has prompted Publisher Wayne Green to launch a full-color glossy magazine bearing that name to help springboard research. The 96-page premier issue hit the newsstands in May.

You may remember news reports of the cold fusion breakthrough when its discovery was announced at the University of Utah by Drs. Martin Fleischmann and Stanley Pons back in 1989. While many in the so-called research "establishment" have spurned the idea, *Cold Fusion*'s Editor, Eugene Mallove, Sc.D., says the technology is "far from dead."

"Cold fusion releases enormous quantities of energy in the form of heat, not radiation, as in hot fusion. This heat energy is hundreds to thousands of times what ordinary chemical reactions could possibly yield," says Mallove, who was nominated for a Pulitzer for his book *Fire from Ice*. "If cold fusion is a heretofore unknown form of benign nuclear reaction—as most researchers in the cold fusion field believe—there is more potential cold fusion energy in a cubic mile of sea water than in all of the oil reserves on earth." A subscription to *Cold Fusion* costs $98 USA; phone (800) 234-8458; FAX (603) 924-8613. *TNX* Cold Fusion *magazine.*

Call for Papers

A call for papers has been announced for the 13th ARRL Conference on Digital Communications. Suggested topic areas include: data communications, computer networking via radio, protocols, packet-radio hardware and software, applications, authentication techniques, digital voice communications, speech compression, multiplexed systems, digital image communications, radio propagation effects, application of new technology to amateur digital communications, digital signal processing, spread spectrum, and state-of-the-art microelectronics.

The '94 Digital Communications Conference will be held in Minneapolis (Bloomington, MN) on August 19-21. Deadline for receipt of camera-ready papers is June 20, 1994. Papers should be sent to Maty Weinburg, ARRL, 225 Main street, Newington, CT 06111; (203) 666-1541, or Internet lweinber@arrl.org. *TNX ARRL*

Massive Global Internet Announced

Two of the richest men in the nation, Microsoft's Bill Gates and McCaw Cellular's Craig McCaw, are pooling their dollars in a $9 billion project to blanket the earth with more than 900 satellites capable of high-bandwidth communications. Separately, Microsoft has invested in a terrestrial radio E-mail network for portable communications devices.

The project was actually invented last year by Edward F. Tuck WD6CRP under the corporate identity of Calling Communications—a name which generated little publicity. That is, until Gates and McCaw recently invested heavily and renamed the venture Teledesic Corp. Tuck is Vice Chairman of the new company.

The FCC application was accompanyed by the obligatory $216,000 application fee. Teledesic expects to offer voice channels, broadband videoconferencing and interactive multimedia channels, along with realtime two-way data services on 880 active plus 84 backup birds. If devoted to voice exclusively, the system could support 20 million users! It will, however, be used to support a smaller number of channels with a higher average bandwidth. *TNX W5YI Report, Issue #8, April 15, 1994.*

Ham to Head PCS Task Force

The FCC's task force on emerging personal communications service (PCS) issues will be directed by Private Radio Bureau Chief Ralph Haller N4RH. Besides serving as a "focal point" for all PCS matters, the new task force will aim to ensure continuity among all of the commission's bureaus and policies.

FCC Chairman Reed Hundt said, "I am confident that under the leadership of Ralph Haller, the PCS task force will lead the commission in the timely development of a comprehensive regulatory framework for PCS."

But, development may not be so timely, according to the *Washington Post*. The newspaper has reported that the development of the PCS service may be delayed at least another year. At last count, 66 Petitions for Reconsideration have been received at the FCC in the wake of last September's adoption of a PCS spectrum plan. The complex plan calls for auctioning off a huge chunk of radio spectrum. *TNX Westlink Report, No. 669, March 31, 1994.*

DBS Service Up and Running

DirecTV—a division of Hughes Aircraft Corp.—has begun sending more than 20 television channels directly to several hundred American homes via satellite. This is the first step in what company officials believe will be a nationwide DBS (direct broadcast satellite) service by the end of the year.

The company recently unveiled its new headquarters in Castle Rock, Colorado, the site of its four 13 meter uplinks. DirecTV plans to add a second geostationary satellite at 17 GHz, operating at what one company official described as a higher frequency than any other FCC-defined service.

Customers will use set-top boxes equipped with RS-232 ports for direct PC or workstation connections and also link directly to telephone lines for billing. The system will support a variety of broadband interactive services. *TNX Electronic Engineering Times, Issue 791, April 4, 1994.*

QRP RFI Calling . . .

The Federal Communications Commission has released the results of a recent study on telephone RFI (radio frequency interference), and the results suggest that transmitter power was not a significant factor in these cases. The telephone interference research was conducted by 35 FCC field offices, each one visiting the scene of three randomly-selected cases. The transmitting stations included 47 citizen's band, 27 amateur, 23 AM broadcast, 10 FM broadcast, and one international broadcast station.

At each location, government investigators tested the telephones in question, FCC "bulletproof" telephones, and a variety of filters. In one-third of the cases, 10 watts or less caused the RFI. Filters were successful in eliminating the interference roughly one third of the time.

The FCC also said, "Manufacturers can design telephones to be interference free." The commission's "bulletproof" phones were immune from the RFI "virtually all of the time." The survey is intended to help the parties "to productively address and resolve this problem." *TNX Westlink Report, No. 669, March 31, 1994.*

Japan Accelerates Information Highway

The country with more ham operators per square mile than you can shake an HT at is revving up plans to build a high-tech information highway. The Tokyo metropolitan government and the Ministry of Posts and Telecommunications is expected to announce a fiber-based multimedia telcom network that will carry interactive cable TV and on-demand video games starting in 1996.

The project is part of a grand national plan to bring fiberoptic telecommunications to virtually all Japanese homes by 2010. Several American and other non-Japanese companies are showing interest in the project, according to a Ministry official. *TNX Electronic Engineering Times, Issue 791, April 4, 1994.*

Number 4 on your Feedback card

MRP4 Solar Panel Control Circuit

Build this easy charge controller for your sun-powered station!

by Michael Bryce WB8VGE

Photovoltaics, the direct conversion of sunlight to electricity, is fast becoming the energy technology of the '90s. It's surprising how much energy the newer generation of solar panels can produce. In the not-too-distant past, you would be lucky to see 1 amp under ideal conditions. Today, a single solar panel can easily generate over 4 amps of charge current under clear, sunny skies.

If the solar array was left connected to the batteries all the time, however, severe overcharging would occur. The results would be rather ugly! You can expect physical damage in the form of warped plates, dislocation of the plate's lead paste and excessive electrolyte gassing, resulting in loss of electrolyte. You can easily destroy a brand-new gelled battery in one weekend if you don't have some means of protecting the battery from overcharge.

To prevent battery damage, some means of controlling the current from a solar panel is needed. This device is called a charge controller.

Charge Controllers 101

There are two basic technologies to charge batteries via solar power: shunt mode and series mode. Let's look a little closer at both methods of control.

In a series controller, a relay or transistor switch is in series between the PV (photovoltaic) array and the battery bank. In this case, the controller monitors the terminal voltage of the battery and will turn off the switch when the battery becomes full. Controlling how long the switch remains open or closed determines the state of charge of the battery. By pulse modulating the switch, a trickle charge can be emulated.

As the name implies, shunt controllers divert array power from the batteries by shunting the PV array to ground. A blocking diode isolates the PV array from the batteries. This prevents the controller from discharging the battery bank along with the array when the array is shorted to ground. By monitoring the terminal voltage of the battery, the controller will start to shunt the extra current when the full charge terminal voltage is reached. Many times, the array's energy is dissipated as heat, usually by resistors. Sometimes the array is shorted directly to ground.

You can short the output of a solar panel to ground without causing any damage to the panel. Here's how it works: Power is a function of both current and voltage—power is equal to current times voltage. With nothing connected to the panel, we have zero power because there is no current flowing. Voltage is maximum, current is zero. On the other hand, shorting the output of the panel generates maximum current, but now there is no voltage. The result is again zero power being produced. In real life, using real-life switches, there will be some voltage drop. Therefore, some of the energy from the panel will be released as heat.

Since most shunt controllers use a power transistor as the switching device, the collector-emitter junction will drop some voltage. This is exactly how a shunt controller works.

The MRP4 Charge Controller

The MRP4 is a simple shunt charge controller that will handle up to 4 amps of array current. That's enough for a Siemens ProCharger 75 panel. The MRP4 will allow the battery to be charged to 100 percent of its capacity without overcharging. It's simple to set up and, best of all, easy to build. A well-stocked Radio Shack can supply nearly all the parts. A PC board is available, as well as a complete kit of parts. You can build the MRP4 for less than $35—much less with a well-stocked junkbox.

A Look at the Circuit

The MRP4's schematic is shown in Fig-

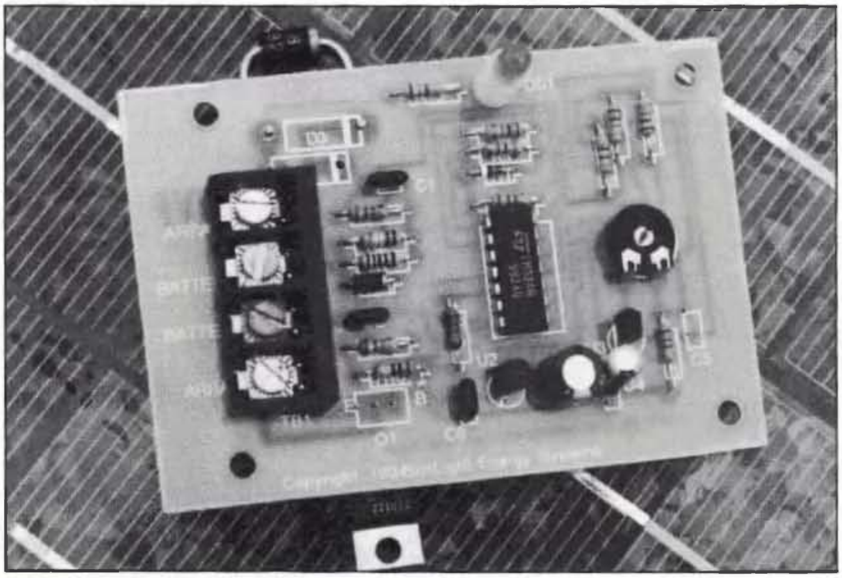


Photo A. The MRP4 Solar Panel Control Circuit. The chip is an LM324 op amp.

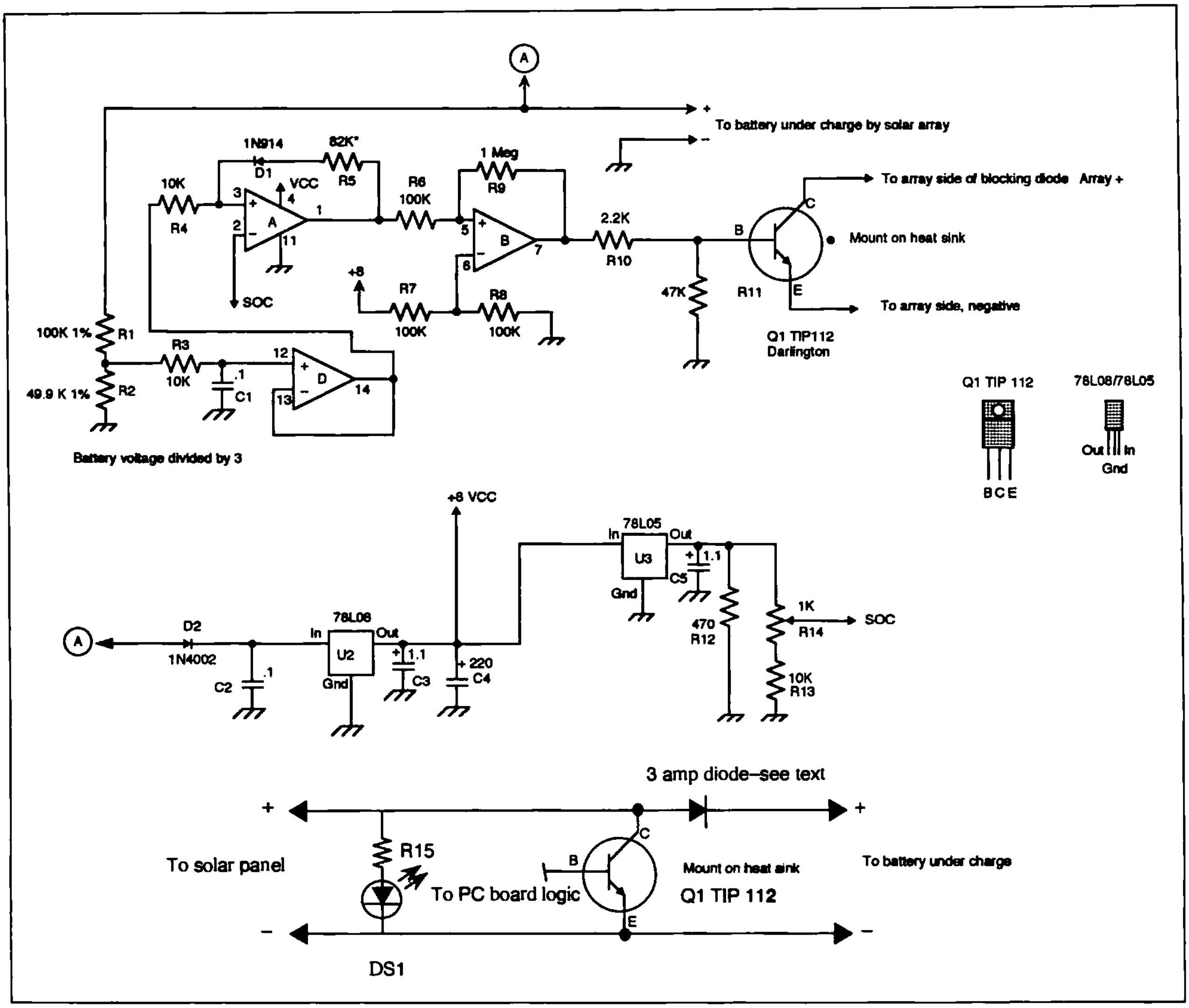


Figure 1. Schematic for the MRP4 Solar Control Circuit.

ure 1. The heart of the project is an LM324 op amp. Only three of the four amplifiers in the chip are used in this project.

To determine the state of charge of the battery, we monitor its terminal voltage. Resistors R1 and R2 divide the battery's voltage by three. Amplifier D buffers this voltage before passing it along to amplifier A. This amplifier is configured as a voltage comparator. The battery's terminal voltage, now divided by three, is compared to the state-of-charge reference voltage.

The state of charge (SOC) is determined by a 78L05 three-terminal voltage regulator. Resistor R12 keeps a constant load on the regulator to improve its stability. Trimmer R14, along with R13, sets the state of charge by dropping the regulated +5 volts slightly. This is our state-of-charge set point. The state-of-charge set point is three times the value. If you want the controller to turn off the charging current at 14.3 volts, then the SOC voltage at pin #2 of U1A would be 4.766 volts. The highest you can set the state of charge is 15 volts. That's the full output of the 78L05 regulator times three.

Even though the battery sense is divided by one-percent resistors, there may be some final adjustment needed to the SOC trimmer for the exact state-of-charge voltage at the battery terminals. The circuit is protected against reverse polarity by a 1N4002 diode.

When the array starts to produce energy, all the array's power goes into the battery via the blocking diode. As the battery becomes full, its terminal voltage will rise. When the terminal voltage reaches the state-of-charge set by R14, the comparator switches states. Some of the output is fed back to the sense line. This raises the voltage of the sense line up slightly. By doing so, we introduce some hysteresis to the comparator.

At the same time, the output also is squared up by the third amplifier. Its output drives the shunt transistor fully on. Since the transistor is fully saturated, it shorts the array to ground. This stops the battery from charging. The blocking diode prevents the battery from being shorted to ground when the transistor turns on.

With the array shorted to ground, the terminal voltage of the battery begins to drop. But, because of the hysteresis, the terminal voltage drops below that of the state of charge. Depending on the value of the resistor in the hysteresis loop, the battery voltage will drop a volt or so. When the terminal voltage drops below the hysteresis threshold, the comparator switches off. This reverses the action of the transistor switch, turning it off. Once again, full array current is allowed to flow into the battery and the process is repeated. The battery is then protected from overcharge by shorting out the array when the state of charge has been reached.

The CHARGING LED will then flash on and off as the shunt transistor shorts the array to ground. The CHARGING LED gets its

operating power directly from the PV array. The rate of flashing will be determined by several factors, such as the charge current from the array and the condition of the battery.

Construction

There is nothing critical about building the MRP4. It can be built using any method you're comfortable with. This includes the use of perf board and dead-bug construction. However, using the PC board designed for the MRP4 speeds construction. The PC board makes troubleshooting easier, too.

This is a simple project, so begin by stuffing the PC board with the resistors. Next add the IC socket and the terminal board. Finish up by installing the regulator and capacitors. The shunt transistor must be heat-sinked. Failure to do so will destroy the device. You can use an aluminum TOP220 heat sink or, by bending down the tab of the transistor, you can use the metal case holding the PC board. If you go this route, be sure you use a TOP220 mounting kit to keep the tab insulated from the case. Likewise, you can bend down the blocking diode and use the case to help heat-sink it, too. Apply a small dab of thermal compound to help conduct the heat to the metal.

Setup and Adjustments

You'll need an adjustable power supply, a digital VOM and a solar panel to adjust the MRP4.

Start by connecting the power supply to the battery terminals. With the power supply sitting at 14 volts, check for VCC on pin #4 of U1. Check the output of the 78L05 regulator. It will be very close to +5 volts. From the wiper of trimmer R14, set this voltage to your state of charge. Remember, it will be your state of charge

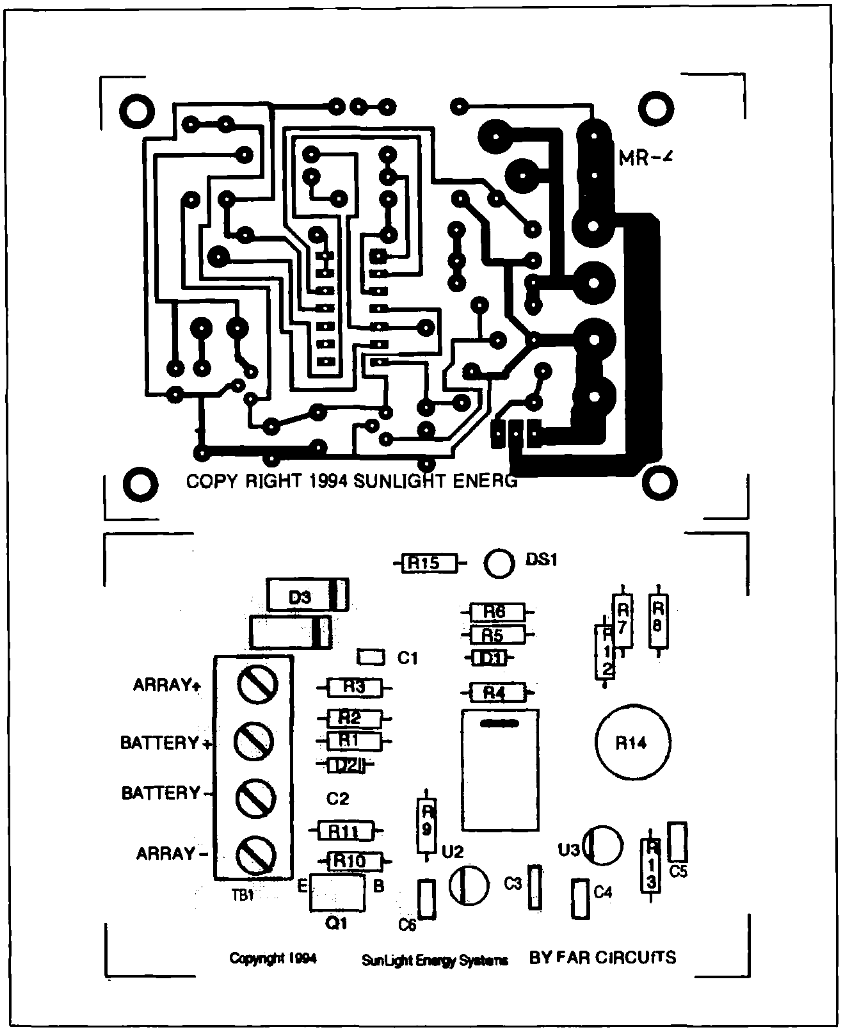


Figure 2. A drilled and etched PC board is available for $4.75 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Ct., Dundee, IL 60118.

divided by three.

Probe the base of Q1 with the VOM. Now slowly increase the power supply voltage. When the power supply reaches the state-of-charge set point, the base will go high. Now slowly reduce the voltage of the power supply. You should be able to drop the voltage down to around 13.5 volts before the base goes low again. This completes the setup and adjustment. You might need to touch up the trimmer if you don't see the exact set point you require. Again, this is because of the slight difference in com-ponents in the battery sense line. During these tests, the charging LED will remain dark.

Final Hook-Up

The only way to really see how the MRP4 works is with a solar panel. So, connect the MRP4 to the battery to be charged first. Then connect the solar panel. Of course, the solar panel needs to be placed in direct sun to charge the battery. The CHARGING LED will come on. When the battery reaches full charge, the charging LED will begin to blink on and off. With an MP75 solar panel, the shunt transistor's heat sink should be politely warm to the touch. Don't use any other source of energy other than a solar panel. Don't use your power supply!

Any time the array produces power, the LED will come on. This may occur without any substantial charging taking place. In fact, bright moonlit nights may make the LED glow slightly!

Uh-Oh! It Don't Work!

If the MRP4 fails to operate, check for VCC on pin #4 of the LM324. Also, you must have the proper reference voltage from the 5 volt regulator.

If the battery won't come up to the state of charge, you may have more load on the battery than the solar panel can replace. Either reduce your loads or increase the charging current to the battery.

An open shunt transistor will allow the battery to become overcharged. Check the base voltage to see if the device is being turned on. If there is base voltage, and the battery is overcharging, then Q1 has failed.

By connecting the solar panel only, with no battery connected to the MRP4, you'll overheat the shunt transistor. This happens because the MRP4 oscillates by turning itself on and then off. Be sure there is a battery connected to the MRP4 when the solar panel is active.

That's It!

The MRP4 will protect your battery from overcharging when you're using a solar panel. It's simple, effective and oh so easy to build. It's a perfect project for a rainy afternoon.

Parts List

R1	100k 1%
R2	49.9k 1%
R3	10k
R4	10k
R5	82k
R6	100k
R7	100k
R8	100k
R9	1 meg
R10	2.2k
R11	47k
R12	470
R13	10k
*R14	1k
R15	1.8k
C1	0.1
C2	0.1
C3	1.1 TAN
C4	200 µF
C5	1.1 TAN
D1	1N914
D2	1N4002
D3	1N5821
U1	LM324
U2	L8LO8
U3	L8LO5
Q1	TIP 112
Heat sink, solder, etc.	
*Trimmer	Mouser #531-PT10V-1k
Terminal block	Mouser #506-4PCV-04

You can change the TIP 112 to a power MOSFET if you wish. The pins of the MOSFET will fit the same holes as the TIP 112. Change R10 from 2.2k to 100 ohms and R11 from 47k to 100k. Nothing else needs to be changed for this modification. You can use just about any low RDSon power MOSFET instead of the TIP 112. I've used an IRFZ44 in the past with very good results.

For more current capacity, there are two extra pads on the PC board for a second 1N5821 diode in parallel.

A PC board is available from FAR Circuits, 18N640 Field Ct., Dundee IL 60118, for $4.75 plus $1.50 S&H.

A complete kit of parts, including the PC board and terminal block, is available for $30 (including first-class postage) from Sunlight Energy Systems, 2225 Mayflower NW, Massillon OH 44647.

Surplus Solar: Is It for You?

An affordable alternate backup power system.

by Donald Koehler N7MGT

Looking for a back-up power source for your station? Want some way to power your equipment that is portable, quiet and earth-friendly? Solar power systems will give you all of this and a bit more. The major objection against solar power from most hams seems to be the cost associated with the system components, especially the panels. This article shows how you can use surplus or repaired panels to reduce your system costs.

New panels, tied into a modern "turnkey" system, can't be beat for overall price, efficiency and hassle-free power. Hams, however, have a demonstrated do-it-yourself attitude, both to save money and to learn more about their equipment and their system's maintenance. With the use of surplus panels, described here, and surplus batteries, described in companion article on page 22, you can save a considerable amount over an all-new system.

What About Surplus Panels?

Current prices are much better than in the past, under $10/watt for new commercial panels. New solar panels are often more efficient, producing more watts per square foot of surface area.

Older panels are, for the most part, repairable. These older panels, made from large round silicon cells or smaller square cells, are hitting the surplus market at very attractive prices. Commercial surplus panels are available for about $4/watt, less shipping. Damaged panels can often be obtained for free locally when purchasing other working panels.

Typical surplus sources for panels are local land mobile (commercial two-way) radio providers, railroad surplus, and small solar dealers. I have listed some sources for new and surplus panels at the end of this article. Don't forget to look here, in the pages of *73*; several companies routinely advertise surplus panels.

Besides the obvious sources listed above, try some of these:

- Billboard maintenance and sales companies
- State highway sign maintenance shops
- Oil and gas pipeline operator/service providers
- Local water/waste water and electrical utilities, especially those with extensive SCADA systems
- Canal and irrigation systems service organizations
- Salvage dealers, commercial and military

Last, but not least, get some magazines, such as *Mother Earth News, Backwoods Home Magazine* or *American Survival Guide*, or others found in your local bookstore or library, then check out the ads. Write for catalogs and ask about surplus, damaged or over-age/canceled orders. Also check on the local repeater—you never know what will turn up.

Testing the Panels

As with anything you may purchase which is labeled surplus, always test the panels before you hand over your hard-earned cash. This way you'll know how many watts you are really getting, not just the panel rating. It takes little effort and just a few basic tools to check the panels. The minimum tool requirements are: a digital voltmeter, an ammeter or shunt for your VOM, and a variable load.

First, give the panel a close visual inspection (see Photo A). Look for cracked cells, lifted or broken interconnect foils, or delaminated surface or backing covers. Once satisfied, attach your voltmeter and ensure that it is on a high DC setting. Point the panel at the sun and read the voltage produced (see Photo B). Write down this indication, then attach a load. I use an old, wire-wound, military surplus rheostat to provide a variable load. Never use a radio or other equipment to check the output of an unregulated panel—you may damage the gear. Unloaded panels can generate anywhere from 18 to 30 VDC at several amperes current, enough to fry your radio or other equipment.

The load should have an ammeter or shunt connected, in series, to read the current produced by the panel. Hook the ammeter PLUS (+) lead to the PLUS (+) lead of the panel. Then hook the ammeter minus (-) lead to the load. The return is from the load to the panel. WARNING: Always hook up an ammeter through a load; used like a voltmeter, the ammeter will be damaged. All set? Now

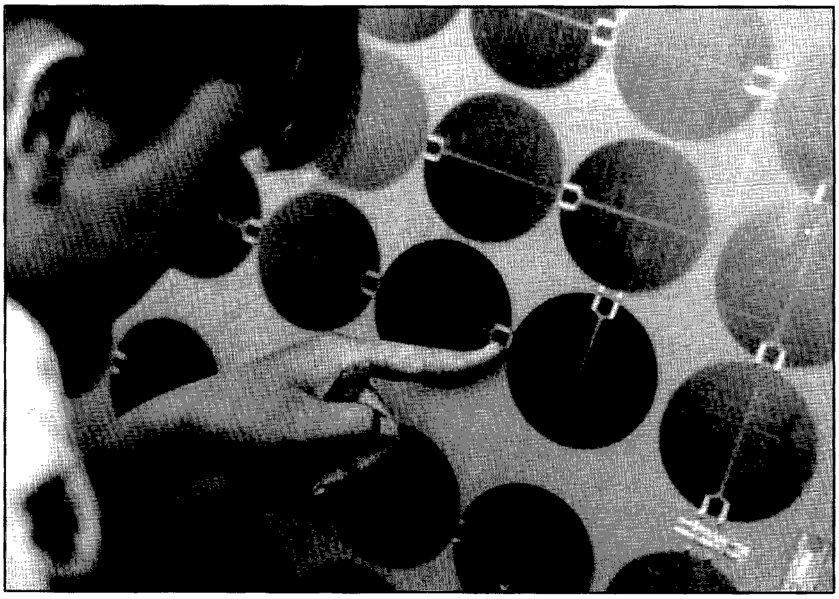


Photo A. Close visual inspection is the first step in testing surplus panels.

point the panel to the sun and read the voltage and current.

Slowly reduce the resistance of the load to increase the current flow produced from the panel. At some point the voltage and current will drop off. Back the load off a bit and note the maximum voltage and current readings. At the same time, take a moment to note the resistance of the load and write it down with all the other data. The rest is easy as pie.

Power equals voltage times current. Power (P) = Current (I) times (X) voltage (E). As an example, a panel you have under test may produce 2.5 amps at 12.5 volts. The panel rating, as measured, is 31.25 watts. Keep in mind that this output will depend on total solar insolution or the rate of delivery of direct solar radiation per unit of horizontal surface area. Simply put, more sun striking the panel produces more power, thus a lower sun angle or shadow results in less power.

What Else to Look For

Anything else to look for while bargain hunting? Added features to look for in a panel are bridging diodes. In newer panels, these diodes allow the panel to continue to produce power even if it is damaged. These panels are worth more than the older type panel pictured in Photo A. Panel frames, interconnect wiring and any tracking devices available should be picked up as part of any deal, if possible. These can improve efficiency of the system and save many of the problems of mounting the panels once home. Use care and the proper gauge of wire and fuses to hook panels to your battery bank. Read the companion articles on finding and testing surplus batteries (page 22) and building a controller circuit (page 10) to complete your system.

Other sources for commercial surplus panels:

SUNELCO Inc., 1-800-338-6844 for orders, P.O. Box 1499, Hamilton MT 59840.

Solar Electric Inc., 4901 Morina Blvd #305, San Diego CA 92117.

Kansas Wind Power, Route 1BW22, Holton KS 66436.

Integral Energy Systems, 109M Argall Way, Nevada City CA 95959.

Photocomm, Inc., 7681 East Gray Road, Scottsdale AZ 85260.

UNI-SOLAR, 1-800-397-2083 for product information, 5278 Eastgate Mall, San Diego CA 92121-2814.

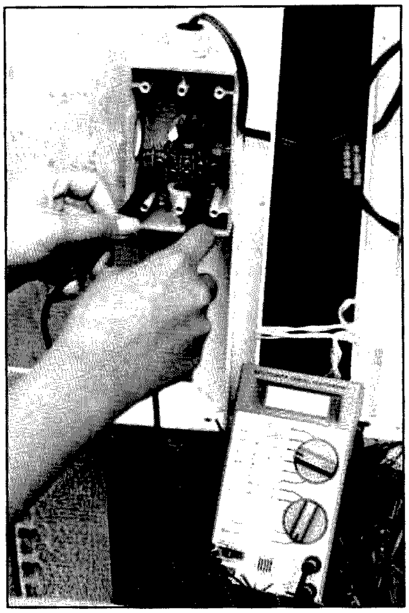


Photo B. Test the panel, using care to observe the polarity of the panel output.

Used Batteries for Ham Stations

Another way to save money on power systems.

by Donald E. Koehler N7MGT

How can you save money on batteries to use at home for solar or back-up power systems? For small stations or any other purpose with limited equipment requirements, purchasing used or surplus batteries may be your best value. This article will explore the where and how of buying used batteries, and will also describe sources, test procedures, and cautions.

Before You Buy

First, when is a battery no longer a battery? Answer, when it is toxic waste or hazardous waste! Before you even start looking for used batteries, find a recycler or salvage business which will take in "dead" lead-acid batteries. Even in the best of deals, I have had to purchase "lots" of used batteries which contained the occasional dead battery. It is better to know you have a place for the legal disposal of any of these batteries before you start. While on the phone, ask what the center will pay for used batteries.

Now then, take a moment to determine the voltage and current requirements for your equipment. Inverters, devices which turn DC current into AC current suitable for regular home appliances, are rated in both volts and amperes. You will find this information on the manufacturer's data plate. If operating DC-powered equipment like a portable HF station or scanner, add up the current draw from each piece of equipment that will be operating together. Write down this total current requirement. Your total battery bank capacity should be at least twice this number for the longest battery life in your system.

For the sake of this article, I will assume you will use equipment requiring 12 or 24 volts and the current draw won't be much more than 30 amperes. Higher current levels will require you to really look closely at engineering practices beyond the scope of the information presented here.

WARNING: While the *voltage* of these batteries may appear to be low, the *current*-producing potential is lethal! See the sidebar for battery safety tips.

What kind of battery will fit your needs? By and large, "flooded cell" or wet cell lead-acid batteries are the easiest to find and least expensive. Gelled-electrolyte and NiCd batteries may be the next best bet for low-current demand applications, typically communications equipment. Any battery you consider should be a "deep-cycle" type. Automotive or truck batteries can be used, they just won't last very long in a solar/battery/inverter system. A good deep-cycle battery, even one you purchased used, should give more than five years of useful service life. New batteries will go more than 10 years; in properly-engineered "float" systems, double that service life can be expected.

Sources for Used Batteries

Start with the local phone book to develop a list of potential sources where you can purchase used batteries. Try local golf courses, material-handling equipment companies, local exchange carriers (the phone company or local cable company), large computer operations (such as banking centers) or, if you're near a military installation, the Defense Reutilization and Marketing Organization or salvage yard. Now let's take a look at each source.

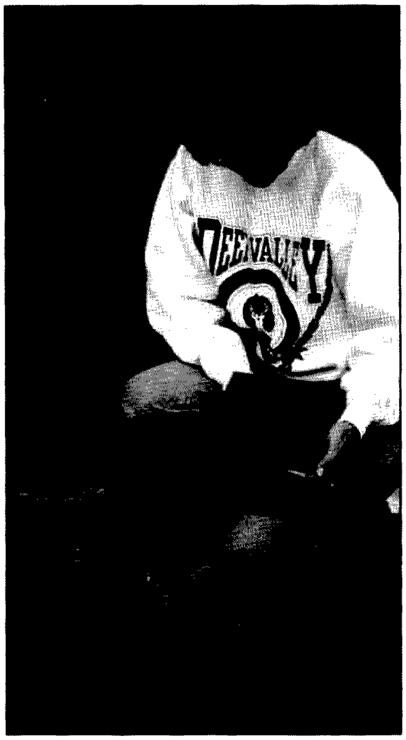


Photo A. These batteries were free for the taking—240 amp/hr. capacity for the effort of hauling them away.

Golf courses in urban areas typically use electric golf carts. These carts typically have six batteries, each one rated at 6 volts direct current (VDC). These batteries are also deep-cycle and capable of large current production. Small enough to move by hand, they are my favorite for small solar systems. Most good-sized golf courses buy batteries by the pallet load and the turnover in used batteries is high. Talk to the greens-keeper or someone in the cart barn. Expect to pay about $3 each. Before you pay, be sure you test the batteries you buy. If you establish a long-term relationship with that golf business, the possibility exists that you can "buddy up" with the course on a battery buy. This will net you a pallet load of identical batteries at a better price than you could get on your own. If a pallet load is too many batteries for your specific needs, split it up with friends.

Material-handling companies that sell or service electric forklifts or pallet movers are another place to try. Batteries used in material-handling equipment tend to be very large and heavy. Local exchange carriers like the phone company use either "glass-wall" cells or large conventional lead-acid batteries. Be careful—a friend of mine picked up a load of glass-wall cells "as a good deal" and some were leaking. The local recycler wouldn't touch them. It cost him major bucks to legally dispose of the now-hazardous waste! I mention these two sources only as a comparison. Very few folks have a need for the current levels these kinds of monsters can produce.

If you are going to power your entire home exclusively with solar recharged batteries, then by all means look for large glass-wall cell arrays. Telco batteries generally have excellent records on service and age. The cells are usually 2 VDC, so it is easy to set up 12 or 24 volt arrays. After all, batteries are where you find them.

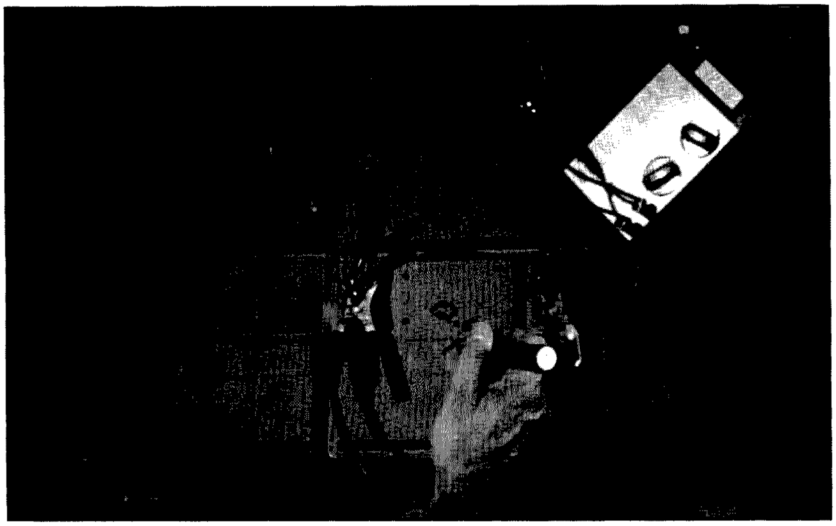


Photo B. Test batteries under load and mark the results on top.

Computer centers with large Uninterruptable Power Systems (UPS) may be a good source of high quality, deep-cycle batteries. About the size of a large auto battery: These cells are small enough to move by hand and most are the gelled-electrolyte type. The cells have "lived" in a well-engineered system, so even cells that are more than five years old should be good for home use. As always, test before you buy. Check with the operations or maintenance supervisor of the local banking or credit card center.

The last source is the Defense Reutilization and Marketing Organization, or DRMO, on a military base near you. This source represents a real crapshoot. My experience is that the folks who work at the DRMO are friendly and helpful, but you have to know what you are looking for in a battery. They can also poll DRMOs in other states or at other bases to see if anything like what you are seeking is available. The big bonus: The batteries they sell are clearly marked as to condition, age and type. Most of the lead-acid and NiCd batteries they sell have been neutralized, to be sold as scrap metal and cannot be re-activated. These can be recognized by the holes drilled into each cell and they will usually be marked with a bright red tag. Sometimes batteries can be found that are still usable. The price is usually pretty good, but the sales are by "lots." Before attending any auctions, go inside and talk to the friendly folks. They really want to sell you something, so ask their advice. I have always received good treatment and a fair deal. Now, how do you test the darn things?

"Before attending any auctions, go inside and talk to the friendly folks. They really want to sell you something, so ask their advice. I have always received good treatment and a fair deal."

Testing Used Batteries

The testing of used batteries is not hard and is a two-part process. You will need a couple of tools. First, a good quality digital voltmeter. Available from retail stores like Radio Shack, they run about the same as an analog (pointer) meter. Second is a "load," something to draw current while you check voltages. I use an old automobile headlamp. The other instrument is a thing called a hydrometer. This is used to check the specific gravity of the battery acid in a wet cell. Be sure you tell the salesperson you will be checking batteries containing acid. You can use the kind that has little floating balls in a tube, available at local auto parts stores or service centers.

Now, another word about safety. *Before* you go out to check and test batteries, let's review some basic safety procedures. One: The darn things are heavy! Use your legs and not your back to lift or move batteries. Second: They contain a powerful acid. When you go to check specific gravity, wear gloves and eye protection! If you are like me, you will follow the advice of professionals and wear a rubber or acid-proof plastic apron, shoe covers and long-sleeved shirts. Old clothes are a must here!

Look at the batteries prior to testing. Are they clean and free from cracks and leaks? Do all of the cells have liquid in them, enough to cover the plates? Are the terminals solidly attached (do they move)? Do the cells each have their own caps or covers, and do they match? They do? OK, let's move on.

Now you are ready for the first test! Take the battery you will test and attach the test leads from your digital voltmeter, being sure to use the correct polarity on the leads. Read the voltage. On a 6 volt battery, fully charged, you should see about 6.3 VDC registered on the meter. Now attach the load. On my auto headlamp, I use a set of old jumper cable clips to allow attachment to the battery under test. The advantage of the headlamp is that I can see it light up, so I know it is pulling current from the battery. The lamp is equal to about a 35 watt load.

With the load attached and drawing current, read the meter. It should not have changed from the first reading. If you are checking several batteries, use a piece of chalk and mark the battery with the two voltages. For instance: 6.3/6.2. Continue on with the rest of the lot. Now you can see, at a glance, which batteries hold up best under a load. Once the batteries are marked, you are ready for step two.

Take your hydrometer and check the

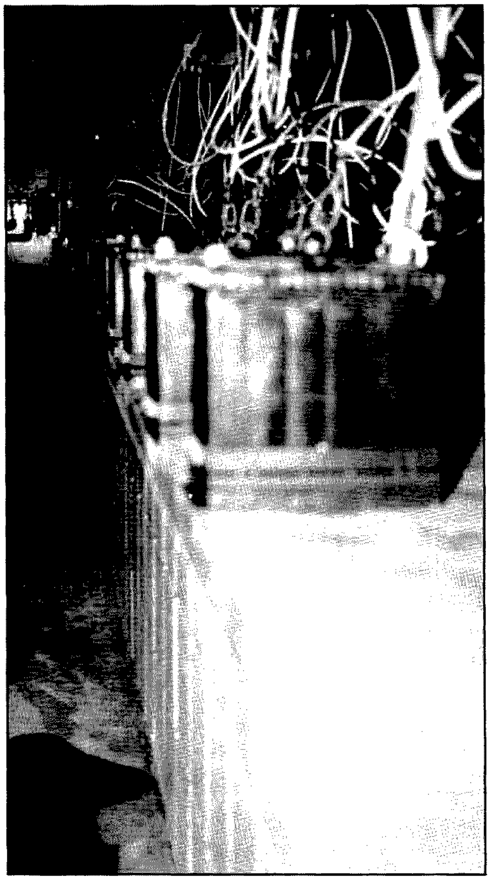


Photo C. Used batteries abound, if you know where to look.

specific gravity (SG). This is a pass/fail kind of test, since it shows the state of battery charge; it does not prove that the battery is good. The specific gravity depends on the type of battery you are testing. Ask what it should be—figures can range from a high of 1.300 to a low of 1.65/1.75. Batteries used in cold climates have an SG of around 1.300. In warmer climates, an SG of 1.65 will allow more current to be pulled from a system battery. Temperature will affect the SG and capacity of the battery. (NOTE: A battery may lose most or even all of its capacity in cold temperatures.) If the battery does not meet the minimum SG, think again about parting with your money.

Remember, clean batteries work better and last longer than batteries which are dirty or corroded. Keep the terminals and outside of the batteries clean—you will save both time and energy.

Now then, how much to pay? Depends. I pay about $3 for used golf-cart batteries, as that is the salvage price. If the battery looks in good shape, passes the tests and is the right size for your needs, go a bit better than the salvage price. Look at it this way: You are saving the owner the cost of hauling his batteries to the recycling center. That is the other reason you checked the price paid by the center first. Drag it home, hook it (or them) to your system and enjoy the fact that you are helping the environment while saving money.

Thanks to the real experts at the 3rd Wing, Elmendorf AFB (AK) battery shop for the DRMO and battery info.

Safety Warnings

Batteries can be dangerous—pay attention to these common-sense safety rules!

- Keep batteries away from children or pets.
- Personal Protective Equipment (PPE): Minimum safety equipment includes acid-proof gloves, eye protection and heavy leather shoes; strongly recommended is an acid-proof apron, shoe coverings and a long-sleeved shirt.
- Batteries are heavy, so use proper lifting techniques.
- Batteries vent hydrogen gas when charging, so make sure your storage/use area has enough air flow to prevent buildup of explosive gases.
- DO NOT SMOKE around batteries, charging or not.
- Use a regulator when charging batteries from a solar system or other unattended method.
- DO NOT MIX battery types or voltages.
- In earthquake country, secure the battery so it won't move or spill.
- It is OK to set batteries on a concrete surface. However, any spilled acid may ruin the concrete.
- Protect terminals so they cannot be shorted together.
- If in doubt, check with a professional battery service organization or dealer. Be safe, not sony.

All About Those Lightweight HF Ham Whips

Easy mobile operating from 160 to 10.

by Gordon West WB6NOA

Operating mobile high frequency from 160 meters to 10 meters can be a real kick on your next vacation, or on a long commute into work. High frequency 100 watt mobile rigs have been scaled down to a size not much larger than an SSB CB rig. The Kenwood TS-50 is a good example.

If you are cramped for space on the dash, you could remote-mount the Yaesu FT-747, or surely find a spot behind the driver's seat for a microphone-controlled ICOM IC-728.

But newer vehicles may make it a challenge for a simple pre-tuned high frequency whip installation. The extra-thin metal bodies—and now composite bodies—could rule out the old ball-mount found on older-vehicle installations. Forget the bumper chain mount—bumpers are no longer metal. And the old standby gutter mount is now out of the picture because newer vehicles don't have gutters anymore!

But there is hope—with special thanks to antenna manufacturers Comet and Diamond. Their adjustable trunk-lip mounts will grab almost any tiny crevice of your newer vehicle, and they stay on securely with four strong Allen screws that clinch the inside of the groove. Look these mounts over carefully and find one that will work with your type of vehicle. You will find them hanging in clear vinyl bags in the antenna accessory section of your local ham radio store. Most dealers will also have a store sample that they may let you take outside to see how well it is going to work on your vehicle.

While these mounts are strong, you may wish to first start off your HF mobile system with an extremely lightweight, pre-tuned HF antenna whip. In other words, you may ultimately work your way up to a heavy Hustler, a heavy Outbacker, or some of the older very heavy whips from Swan or Webster—but start out "lightweight" first.

Extremely lightweight, one-quarter-wavelength, helical, center-loaded whips are always available at hamfests, seen hanging on a blister-pack card for any single ham band from 160 meters through 6 meters. One whip per band. Examples are:

- •Lakeview WD4BUM mobile HF whips
- •Valor Pro Am HF mobile series
- •Wintenna Hamstick
- •ASA Fiberwhips
- •Anttron SingleBanders

There may be others, but each of these "different" lightweight whips share similar characteristics:

- •Almost identical TX/RX performance as 8-ft. heavyweight whips.
- •Incredibly lightweight—15 ounces for 17-meter whip.
- •Hollow 4-ft. helical-wound Fiberglas shaft.
- •Tunable 4-ft. stainless steel whip.
- •3/8" x 24 ferrule for trunk-lip or ball mounts.
- •Low price—seen selling for under $19.95 each at ham shows.
- •Change bands, change whips—30 second operation.

To test the "TX/RX performance" of these whips, we hooked up a solid-state transceiver—a unit *without* a built-in antenna tuner—to a professional heavy-duty, 50 ohm, five-position switch, going to the following station wagon roof-mounted antennas for an on-the-air comparison:

- •Hustler 1/4 kilowatt, single-band whips
- •Outbacker 6-foot whip
- •Different manufacturers' Fiberglas/stainless whips
- •Nearby house-mounted five-band trap vertical
- •Cushcraft three-element beam

The beam always did best. The five-band trap vertical was second-best. The mobile antennas from all of the different manufacturers were certainly no match to the beam, but relatively close to the home-mounted 5 BTV.

When we tested between different mobile whips, including different Fiberglas/stainless whips, there was not one whip that did a whole lot better than the others, nor any one that was substantially down in the mud from the others. The 50 ohm coax switch allowed us to rapidly switch between the different antennas to get away from the typical band condition of up-and-down fading having nothing to do with the type of antenna being used.

Each manufacturer claims superiority over their competition, even though the whips may initially give equal performance.

"The Lakeview whips can take up to 600 watts, and even a kilowatt for a few seconds without going up in smoke," comments Butch at Lakeview. "I have never charged for a warranty repair, and we have never seen water pool in the shaft," adds Lakeview. An inherent problem with these whips could be moisture streaming down the outside of the stainless steel shaft, creeping into the hollow body of the whip, and pooling at the base like a rain gauge. The accumulation of water will dramatically change the base impedance, and could ultimately seep into the mount and cause problems down here. Lakeview claims this has never been a problem because of the tight fit of the tunable whip tip into the top ferrule.

"We use two set screws to keep our whip tip in place, rather than just one like the competition," comments Jeff at Wintenna. "We have made a lot of the antennas that are sold under other names," adds Wintenna. The Wintenna dual set screw doesn't require an Allen wrench to adjust—it is a slotted head, which means you have one less adjustment tool to lose in your mobile installation. We liked this. The Wintenna warranty is for a lifetime—a six-month free replacement,

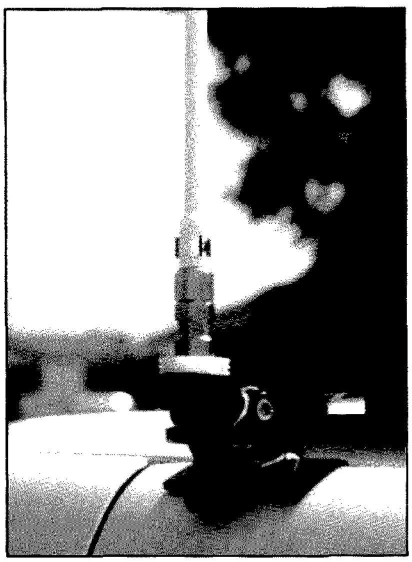


Photo A. The simple hatch mount will hold the lightweight whips on your vehicle.

Photo B. A capacity top hat extends the resonant points on a 40 meter antenna, so no tuner *is needed!*

and a 50 percent cost replacement thereafter.

Valor also makes their own HF mobile antennas, and they stress that their 20-gauge copper wire on a 3/8" Fiberglas rod with nickel-chrome-plated brass ferrules is superior to all of the other antennas out in the marketplace.

"The upper whip is 17-7 taper ground, stainless steel, and provides the user the ability to fine-tune the antenna by sliding the whip in a special ferrule until the desired resonant frequency is found," comments Gerry Stephens W8LLW, vice president of engineering at Valor.

"Our antennas are covered by a one-year limited warranty. If someone discovers a manufacturing defect, we will offer full replacement at no cost," adds Stephens. The Valor whips are rated at 250 watts PEP, but I have personally run them at 600 watts and haven't blown one up yet. Yes, the helical center-load gets mighty warm after about three minutes of high-power talking.

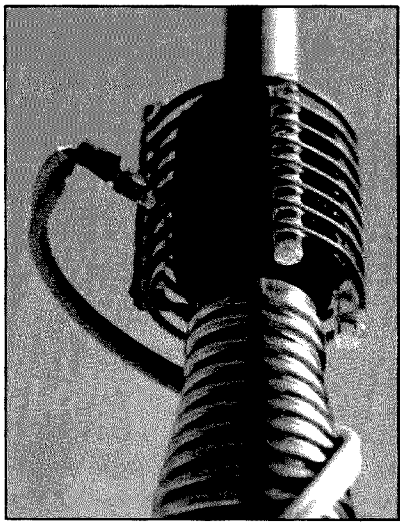
The Anttron HF whip seemed well-constructed, with the same gauge of helical windings that the other antennas have. The Anttron whips feature a single screw for securing the stainless steel whip into the shaft, and it takes an Allen wrench (supplied) for this simple adjustment.

The ASA "Fiberwhips" are made by Valor. They feature a screw-in top ferrule for pre-set tuning. In our tests, we found that we could use a single whip tip that would be interchangeable at its pre-set length to all ASA and all Valor whips down to the 40 meter band. On 75 and 80 meters, whip adjustment is an absolute necessity for all brands of whips.

"Our $17.75, less expensive, Fiberwhips have a one-year warranty from date of purchase, and the tapered top screw-in ferrule helps eliminate the problem of water seepage on the inside of the hollow shaft," comments Jim Wood of ASA. "... We suggest a small amount of Coax Seal or silicon flexible sealant for the top whip where it goes into the ferrule for anyone in a heavy wet-weather environment," adds Wood. Good advice—on any of these whips from all manufacturers, a little glob of something where the stainless steel whip goes into the shaft is a great idea.

Center-loading of these whips from all manufacturers—including a lazy helical wind-down to the base—offers good bandwidth at each band:

6 meters	1000 kHz
10 meters	500 kHz
12 meters	300 kHz
15 meters	200 kHz
17 meters	175 kHz
20 meters	150 kHz
30 meters	100 kHz
40 meters	55 kHz
75 meters	33 kHz
160 meters	12 kHz



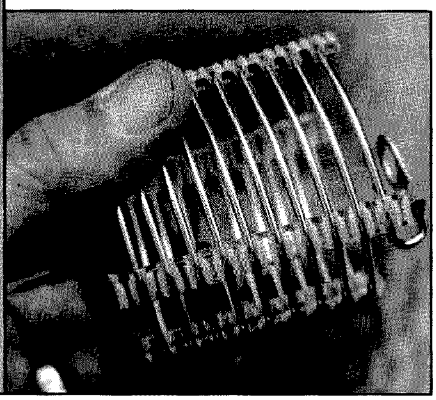


Photo D. It may take a coil to resonate the 75m and 40m whips on some vehicles.

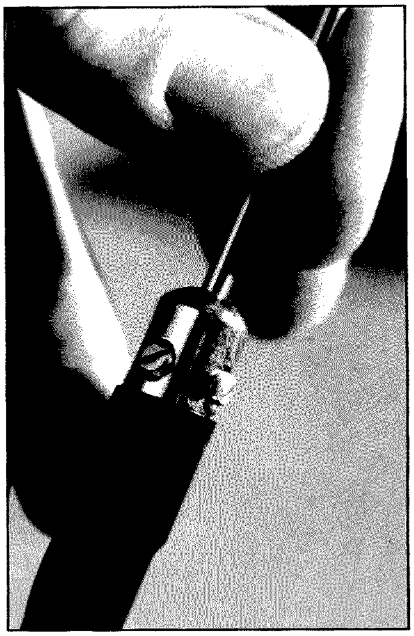


Photo C. Seal this slip-joint to keep moisture from entering the hollow shaft.

We found that where we mounted the whip on our vehicle, 40 meters, 75 meters, and 160 meters made a *major* difference in how low the SWR would dip after fine-tuning the whip tip. In some cases, a disc capacitor in shunt with the feed point assisted in bringing the feed point impedance back up to a target 50 ohms. Valor includes some of these disc capacitors with some of their antennas.

In other cases, it took a coil from Antennas West to give us a better match on the lower bands. Newer transceivers with built-in automatic antenna tuners can also help resolve this mismatch problem between the antenna and feedline and the 50 ohm rig. While the built-in tuner doesn't solve the feed point problem, it will allow your radio to put out more power into a seemingly resonant load. Nothing beats working with an antenna bridge to define a feed point problem and resolving it by either relocating the feed point to another part of your vehicle, or working with coils or capacitors to bring the antenna into resonance.

So if you are looking for a cheap HF whip, take your pick from what is offered by these manufacturers. Some whips come in colors, too. But be sure to ask the seller how long they expect the colored plastic jacket on the outside of the whip will last. Some whips won't make it through the summer exposed to the sun every day. Yet, others may go through several years of hot and freezing before the plastic ultimately begins to crack and peel off. And when that happens, you can either "roll your own" for a re-wrap, or toss it in the trash can and buy another one for under $20. With this type of whip, you get great value at an incredibly low price.

Mobile-ON Alarm/Timer

This little circuit could save your car's battery.

by James W. Elkins, Jr. KA8PHO

At one time or another, we have all walked away from our cars and trucks with the mobile rig still powered up. I have done this on many occasions. I don't like the thought of draining the battery. I don't like the thought of the radio accidentally transmitting an unidentified signal, either. The latter could tie up a repeater for hours, or until the culprit is discovered. With these thoughts in mind, I decided that it would be nice to have a control system that would remind me that my equipment was still on. An alarm would do nicely, but another thought that crossed my mind was that I occasionally operate mobile during public service events and so I need to be able to use the radio gear when the car is shut off. I decided that a time delay circuit could be incorporated into the control, to bypass the alarm but still shut itself off after a predetermined time.

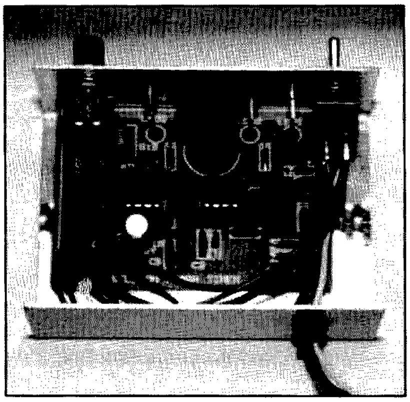


Photo A. A bird's-eye view of the Mobile-ON Alarm/Timer circuitry.

The circuit that I put to work for myself is shown in Figure 1. I decided to call it the "Mobile-ON Alarm/Timer." It is a simple but effective device, easy-to-assemble and to install with minimum wiring. The completed unit was placed in a Ten-Tec enclosure, painted and labeled to keep its appearance neat in the automobile. Relay K1 is a heavy-duty type used for switching higher current loads. This keeps you from having to run heavy wires to the circuit, so it could be mounted under the hood near the vehicle's battery terminals. You will also notice from looking at the schematic that I color-coded the wiring. This, I thought, would make it easier to trace back any wiring, if the need ever arises. Nothing is more aggravating than opening the hood and finding a massive amount of red and black wires to weed through. Smaller-gauge wiring can be used to run back to the control box; 18 or 20 gauge should work fine.

Operation

Three LEDs are mounted through the front of the enclosure. They provide status indications of the circuit. LED 1 will light when the vehicle's ignition is on, or while the car is running. Switch S1 in the ON position will close relay K1, completing the power circuit to the equipment. If the ignition switch is shut off, and switch S1 is still in the ON position, an alarm (piezo) will begin to beep and LED 2 will flash. Returning S1 to the center position will shut everything off. If operation of your equipment is desired after shutting off the vehicle, you can place switch S1 in the AUTO position and momentarily press S2, a normally-open push-button. Depressing this begins a timing cycle. The length of the time period that the Mobile-ON Alarm/Timer operates before shutting everything off can be "programmed" by selecting R6. The approximate time delays are provided in the chart with the Figure 1 schematic. Or, you could instead change C6. These components control the holding time of relay K1. LED3 will light while the circuit is in AUTO status. Incidentally, you can also cancel the time delay at any time during the delay period by simply switching to OFF.

As shown in the Parts List, all of the parts can be easily obtained from your favorite store, catalog supplier, outlet, or surplus parts dealer. The cabinet I used is a Ten-Tec type, number TP-14, but any enclosure that suits your taste will suffice. A small hole was drilled approximately 1/4" to 3/8" in the

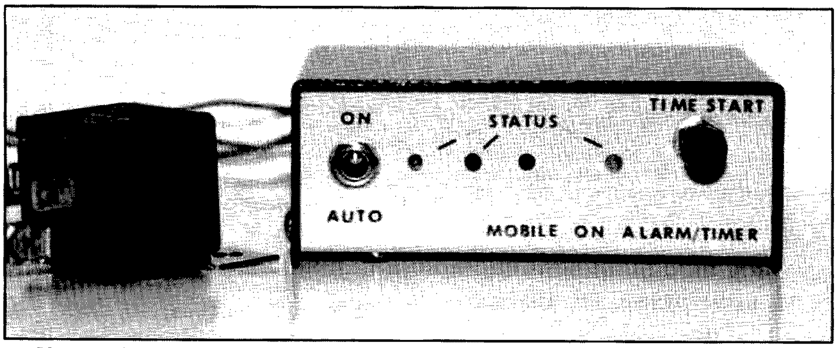


Photo B. The finished unit looks presentable in this painted and labled metal enclosure.

Parts List

Resistors, (1/4 or 1/8 watt)	
R1, R5, R8	1000 ohm
R2, R3	100k ohm
R4	470k ohm
R6	Select for time (see Figure 1)
R7	150 ohm
Capacitors (All capacitors 25 or 50 volt ceramic disc type, except C6, which is electrolytic type, 16 volt.)	
C1, C2, C4, C5	0.1 µF
C3	0.01 µF
C6	100 µF
Semiconductors	
U1, U2	NE555 timer
D1, D2, D3, D4	1N4148 diode
LED 1	Green T1 type
LED 2	Red T1 type
LED 3	Yellow T1 type
Relays	
K1	Radio Shack #275-226 SPST 12 volt, 30 amp (not on PC board)
K2	Radio Shack #275-241 SPDT 12 volt
Piezo alarm	Radio Shack #273-074
Switches	
S1	DPDT center off, toggle, Radio Shack #275-620
S2	Normally open, momentary, Push button type.
Cabinet	Ten-Tec type TP-14 or similar
Color-coded hookup wire	
In-line fuse holder	

Drilled and etched PC boards with component placement silk-screened on them are available from Far Circuits, 18N640 Field Court, Dundee IL 60118 for $3.50 plus $1.50 S&H per order.

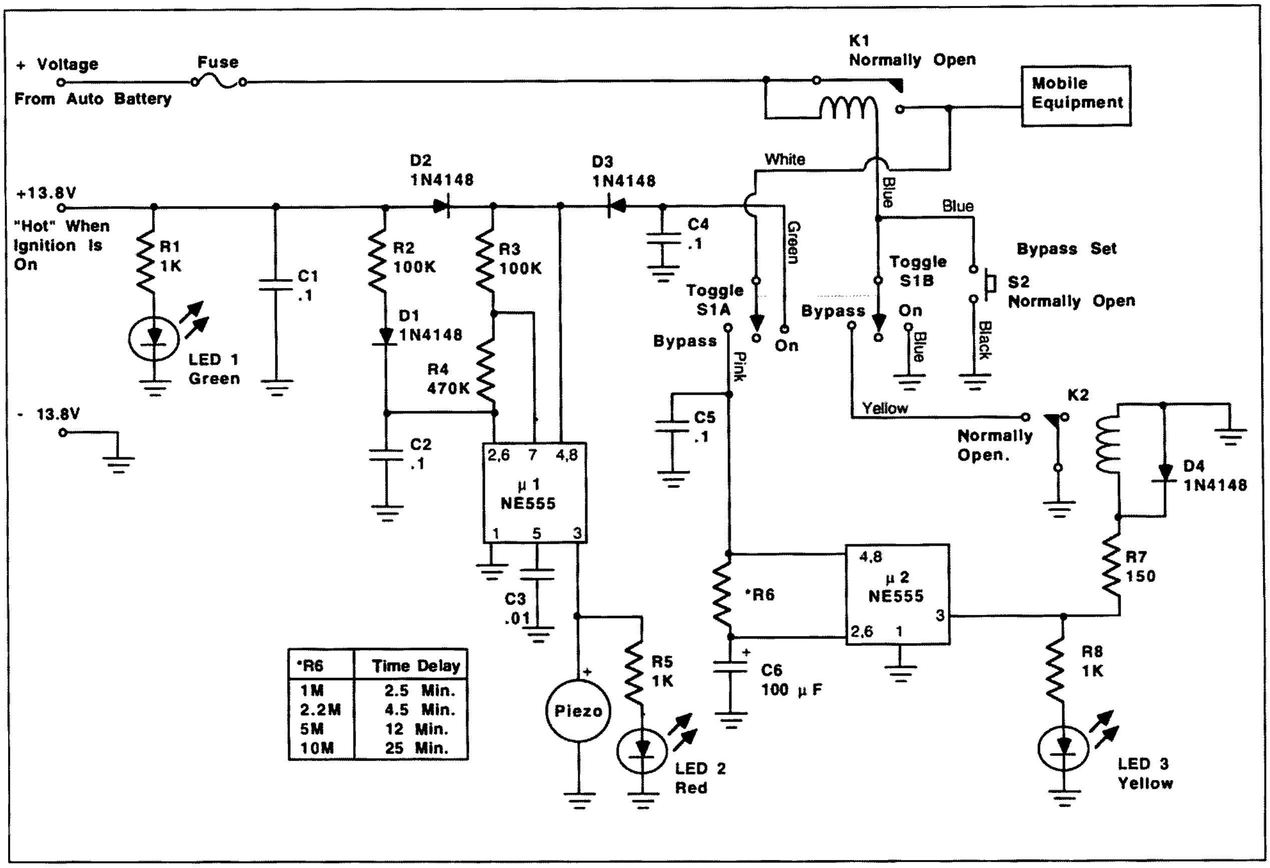


Figure 1. Mobile-ON Alarm/Timer. Notes: 1) K1 and the fuse are not on the printed circuit board; these are located elsewhere in the vehicle. 2) The colors are shown to help reference the wiring to switches, relays, and board.

front to permit the audio tone emitted from the piezo alarm to be heard better. Additionally, a piece of felt or similar material was glued to the inside front panel to keep dust out of the enclosure.

The circuit is probably best assembled on a printed circuit board, but a copper-clad perf board would work also. A PC board etching pattern (Figure 2) is shown, for those of us who have access to making a board, or would like to use one of the popular kits. Alternately, a board with component layout silk-screened on it is available from Far Circuits, 18N640 Field Court, Dun-dee IL 60118 for $3.50 plus $1.50 S&H per order. Location of the components on the PC board is shown in Figure 2.

After assembly is completed, recheck your wiring to the relay and double-check for solder bridges, etc. Be sure that the correct polarity of the electrolytic capacitor is followed, and that the diodes are installed correctly. Also note that a fuse for the + power lead is installed in line to the relay contacts. The fuse should be able to handle just slightly more than your equipment draws. Most equipment is fused in the factory-supplied power leads, but adding a main fuse can help here in case of a short near the relay.

I believe that after installing the Mobile-ON Alarm/Timer in your car you will enjoy its operation, and be satisfied knowing that you will not forget to turn off the power to your equipment. And, even if you leave it on in the AUTO position, it will shut everything off for you in a matter of minutes.

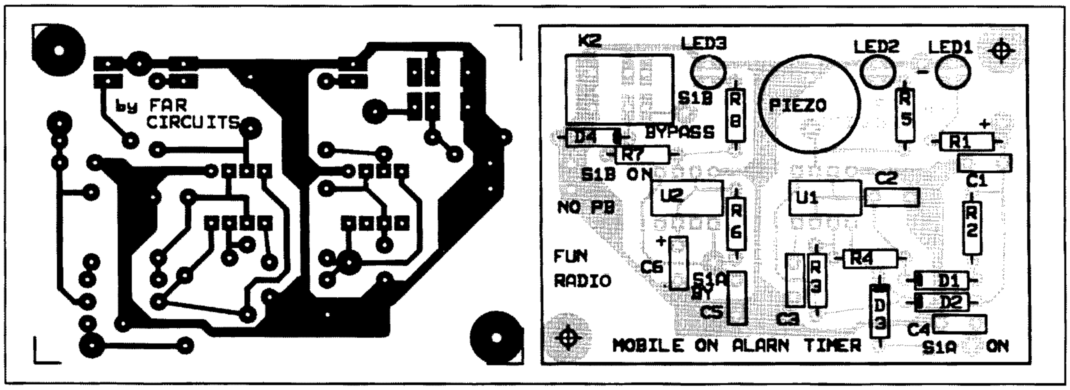


Figure 2. PC board etching pattern and component placement.

73 Review

Number 9 on your Feedback card

by Peter Putman KT2B

Midland International Corporation
1690 North Topping
Kansas City MO 64120
Telephone: (816) 241-5000
Price Class: 18-300 (including the magnetic mount)—$59.95; 18-330B—$29.95; 18-325—$49.95; 18-318 (mag mount alone)—$32.95; 18-316 (trunk mount alone)—$24.95.

Midland Corporation's Models 18-300, 18-325, and 18-330B Mobile Antennas

Sturdy whips for VHF and UHF operation.

Midland is back! After many years, Midland International Corporation of Kansas City has returned to the amateur radio world with a new line of antenna and radio products. Among them are several models of antennas for both 2 meters and 70 centimeters, along with a variety of mounting schemes.

All three are extremely sturdy antennas, and are available in several base configurations, including the popular "NMO"-style mount, which all three review antennas used.

The POWER-MAX 18-300

This antenna is your basic, garden-variety 5/8-wavelength whip, similar to the popular Larsen model. As shipped, the element measures about 54", and you'll have to cut it to the correct length before installation. This can take a bit of effort as the element is made of 17-7 stainless steel! The recommended procedure is to measure the desired cut location, then score the whip with a saw, file or grinding wheel. The excess can then be snapped off by bending it with a good-sized pair of pliers.

Midland provides a cutting chart which gives rod lengths all the way from 138 MHz to 174 MHz. For 146.000 MHz the optimum length is 49.02", so I cut it to exactly 49" and let it go at that. The rod is *extremely* stiff—much heavier than a comparable Larsen whip. In fact, my overall impression of the 18-300 is its sturdiness and weight—this is not a cheaply-built mobile antenna. (Photo A shows the magnetic mount and coil assembly.)

An Allen wrench is provided to fasten the whip into the coil assembly, which in turn screws onto the magnetic base. Having done this, I decided to run a series of measurements using a Bird Model 43 wattmeter and the roof of my car to check VSWR across the entire 4 MHz of 2 meters (Table 1). Oddly enough, I saw the best match towards the lower end of the band, indicating that the rod could have used a bit more "clipping!" However, since the overall SWR was under 1.6:1 at 148.000 MHz, I didn't bother.

Received signal reports and usable range with my Kenwood TM-221 correspond closely to my existing setup, a Larsen KulRod 5/8" whip and coil. The two antennas are interchangeable, but the biggest difference is the increased weight and sturdiness of the Midland whip. The most critical test I can put an antenna through is the "garage door spring-back," and while I've bent quite a few Larsen whips pulling into and backing out of the garage, the 18-300 whip is so strong it actually pops the magnetic mount loose and topples over! According to John Chass WØJLC, Vice President of Marketing for Midland, this is the heaviest mobile whip on the market today and it has considerable "spring" to it, so *be careful* when you bend it for any reason

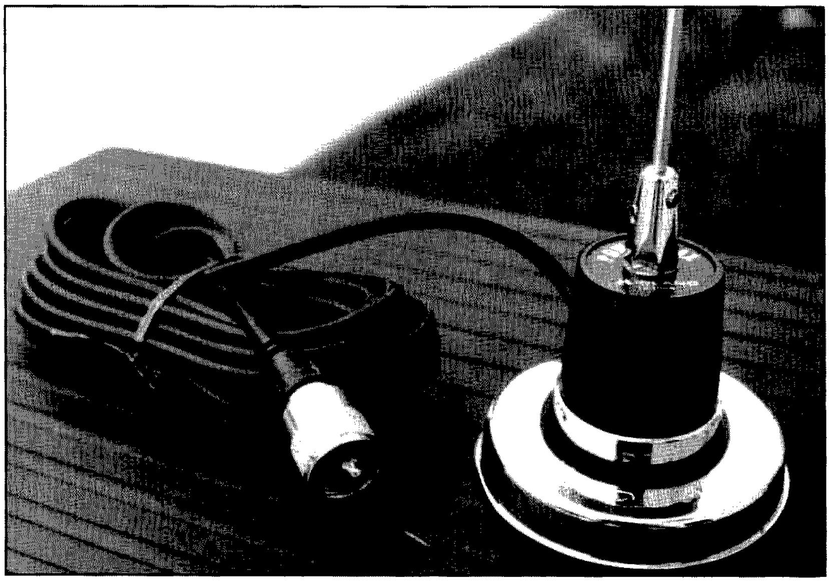


Photo A. The 18-300 5/8 wave mag mount and whip.

Frequency	Measured VSWR
144.000	1.1:1
144.500	1.1:1
145.000	1.1:1
145.500	1.15:1
146.000	1.175:1
146.500	1.2:1
147.000	1.4:1
147.500	1.5:1
148.000	1.6:1

Table 1. 18-300: VSWR vs. frequency.

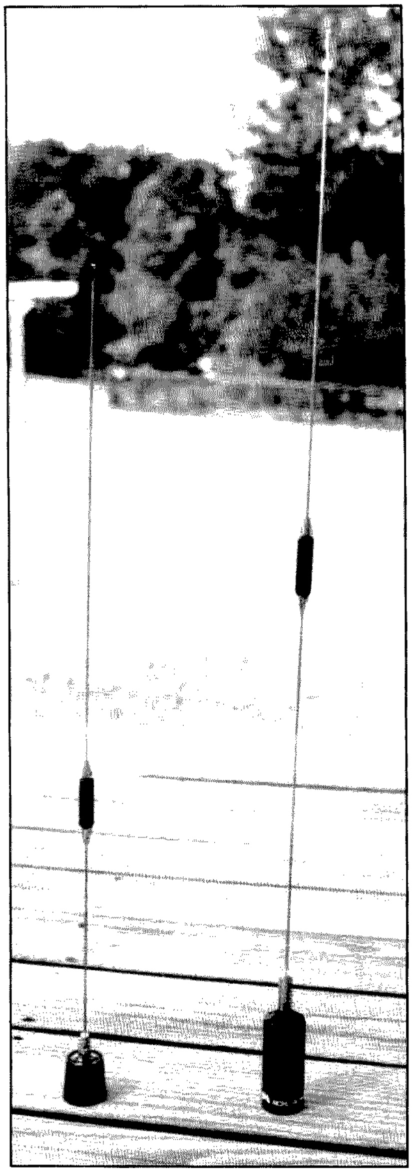


Photo B. The 18-330B (left) and the 18-325 (right).

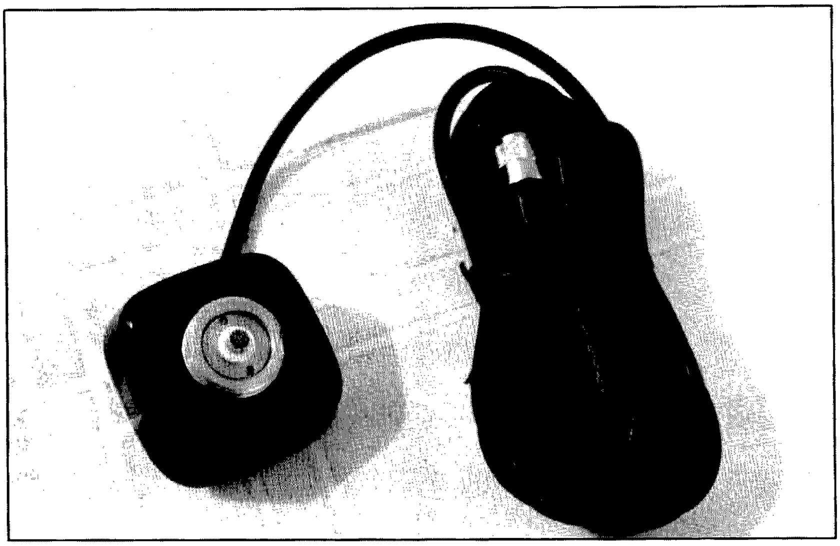


Photo C. The 18-316 trunk mount.

as you can get a nasty "whack" on the head, or elsewhere on your body!

The 18-330B 70cm Antenna

For the 70cm enthusiast, Midland has brought out a 5 dB collinear antenna which utilizes the same NMO mount as the 18-300. Again, 17-7 stainless has been used for both whip sections and you'll need to score the antenna before cutting it to the proper length. Photo B shows the relative size of the 18-330B and its dual-band cousin, the 18-325.

There are actually three versions of the 18-330, and the "B" option is specified to cover the frequency range 445-475 MHz. It might seem a bit odd to leave off the lower 5 MHz of this band segment, but in reality the measured VSWR is low enough with one cut to obtain 10 MHz worth of coverage (see Table 2). Using the supplied chart, I cut the lower rod as suggested to 7-7/8" inches, then watched it roll off my outdoor dining table and disappear through a crack in my deck!

After much cussing, swearing and "fishing," I retrieved the missing rod and completed assembly of the antenna. The moral of the story: Leave either the bottom coupling nut or the coil attached when cutting the rod so you don't feel as foolish as I did! With a Yaesu FT-790RII and Bird 43, I took measurements across the band and found the worst-case SWR to be 1.8:1 at 440 MHz, dropping to 1.4:1 from 444 to 450 MHz. I probably cut the rod just a bit too short, but 1.8:1 only amounts to 9% reflected power and the Yaesu was quite happy. I suggest starting at 8" and working down from there to get the best match.

"...this is the heaviest mobile whip on the market today and it has considerable 'spring' to it, so be careful when you bend it for any reason as you can get a nasty 'whack' on the head, or elsewhere on your body!"

The 18-325 Dual-Band Antenna

For those of us who can't decide between these two antennas, Midland has introduced the 18-325 dual-band mobile whip, again constructed of this incredibly strong 17-7 stainless material. It is also available in the popular NMO configuration and, unlike its relatives, requires no adjustments whatsoever. (This means no more trips under the deck!)

The 18-325 is another "stacked" configuration: It works as a 5/8-wave antenna from 144-148 MHz with 2.4 dB nominal gain, while from 440-450 MHz it behaves in a collinear fashion with 4 dB nominal gain. (For those not familiar with the term "collinear," it is used to describe a design where two or more radiating elements are fed in series to achieve a lower angle of radiation and increased gain in the horizontal plane.)

Out of the box, the 18-325 exhibits a fairly broad SWR curve on both bands, measuring 1.7:1 at 440 MHz and 1.4:1 at 450 MHz (see Table 3.) The dip is fairly shallow, so the antenna can be said to be "broad-banded." On 2 meters, the results are not quite as good, starting at about 1.9:1 at 144 MHz and dropping to 1.25:1 at 148 MHz. However, these results are quite acceptable on both bands. For the most part, I don't fret much with matches below 2:1 at these frequencies, as this amounts to about 11% reflected power. Today's mobile radios can handle this with ease.

Both the 18-330B and 18-325 perform well in over-the-air tests, although the 18-330B seems to be just a tad better, as you might expect for a single-band antenna. Although I only ran 25 watts power on 70cm, both antennas are capable of handling in excess of 200 watts. On-the-air signal reports were excellent (primarily on simplex), and both antennas behaved similarly while driving through hilly terrain. Most importantly, both survived the "garage door jam" test with flying colors. These antennas will certainly hold up over the long term! (Now, if this bump on my head would just go away . . .)

Other Observations

All three antennas employ a base loading/matching coil which is encased in Lexan, the same stuff they make football helmets out of. All finger contacts are gold-plated to ensure

Frequency	Measured VSWR
440.000	1.9:1
441.000	1.7:1
442.000	1.5:1
443.000	1.2:1
444.000	1.15:1
445.000	1.1:1
446.000	1.15:1
447.000	1.2:1
448.000	1.4:1
449.000	1.4:1
450.000	1.4:1

Table 2. The 18-300B: VSWR vs. frequency.

Frequency	Measured VSWR	Frequency	Measured VSWR
144.000	2:1	440.000	1.75:1
144.500	2:1	441.000	1.75:1
145.000	1.8:1	442.000	1.6:1
145.500	1.7:1	443.000	1.55:1
146.000	1.65:1	444.000	1.5:1
146.500	1.5:1	445.000	1.5:1
147.000	1.4:1	446.000	1.5:1
147.500	1.3:1	447.000	1.5:1
148.000	1.2:1	448.000	1.6:1
		449.000	1.6:1
		450.000	1.6:1

Table 3. The 18-325: VSWR vs. frequency (144/440 MHz).

low-resistance junctions, and the internal coils are silver-plated. Additionally, the top ferrulle nut is made from brass, with three layers of stainless plating. Add in the 17-7 stainless whips and you have a *very* durable antenna!

All three Midland antennas are designed to work with one of three different mounts: The 18-316 trunk mount (Photo C), 18-312 roof mount (not reviewed), or the 18-318 magnetic mount supplied with the 18-300 2 meter antenna. The 18-300 5/8-wave 2m gain antenna retails for $59.95 (including the magnetic mount), while the 18-330B sells for $29.95 and the dual-band 18-325 comes in at $49.95. The 18-318 magnetic mount is available separately for $32.95, while the 18-316 trunk mount can be yours for $24.95.

73 Review

Number 10 on your Feedback card

by Donald E. Koehler N7MGT

Rayovac
P.O. Box 44960
Madison WI 53744-4960
Telephone: 1-800-237-7000
Price Class: Four-pack of AA cells—$5.99; Power station for four AA cells—$15; Power station for "family of AA to D" (will handle up to eight cells of any mix)—$30.

The Rayovac Renewal Battery

A ham's dream cell.

If I could just find something cheaper than NiCds, some kind of battery that is rechargeable and has a good power density. Maybe Molicells or something more exotic, perhaps a Zinc-Oxygen cell pack or Nickel Metal Hydride battery.

What is a ham to do for real portable power? Now the folks at Rayovac have answered my needs with a new rechargeable alkaline battery: the Renewal cell.

Based on technology purchased from a Canadian company and then refined by Rayovac, the Renewal battery is one of the hottest new batteries to hit the market in years. Why? Because it offers power density every bit as good as that of conventional alkaline batteries, at a reasonable cost, and with none of the quirks of NiCd batteries. It even boasts several "green" features, such as almost no mercury content and no cadmium at all. A claimed shelf life of five years, coupled with the ability to be recharged, make a sure bet that this battery is going to be a hit with portable radio users everywhere. Even better, it's sure to be a hit with serious ham operators as well. I've tested the battery and I'm sold on it. Let me share my test results with you.

Test Results

Since the battery-powered portable equipment you use and how you use it will be different for everybody, how could I test a battery for performance? After some thought, I designed a performance test for comparing different types of batteries. While the test may not directly relate to any specific piece of equipment, it does allow for a straight one-to-one performance comparison under controlled conditions. The test also has the advantage of being easy to repeat. The battery under test, in this case (a single AA battery), is hooked to a constant current "sink." In this test the current sink is a common flashlight bulb. It will draw an almost steady current under varying voltage conditions. In other words, as the battery drains, the voltage drops but the current draw due to circuit resistance in the test "loop" remains essentially the same. The voltage and current in the circuit were monitored and the results recorded. Test cell voltage was monitored by a digital voltmeter, the current by a precision Fluke Model 8000 milliammeter. The resulting data points were recorded and are displayed in Figures 1 and 2. Please note the overall

Continued on page 42

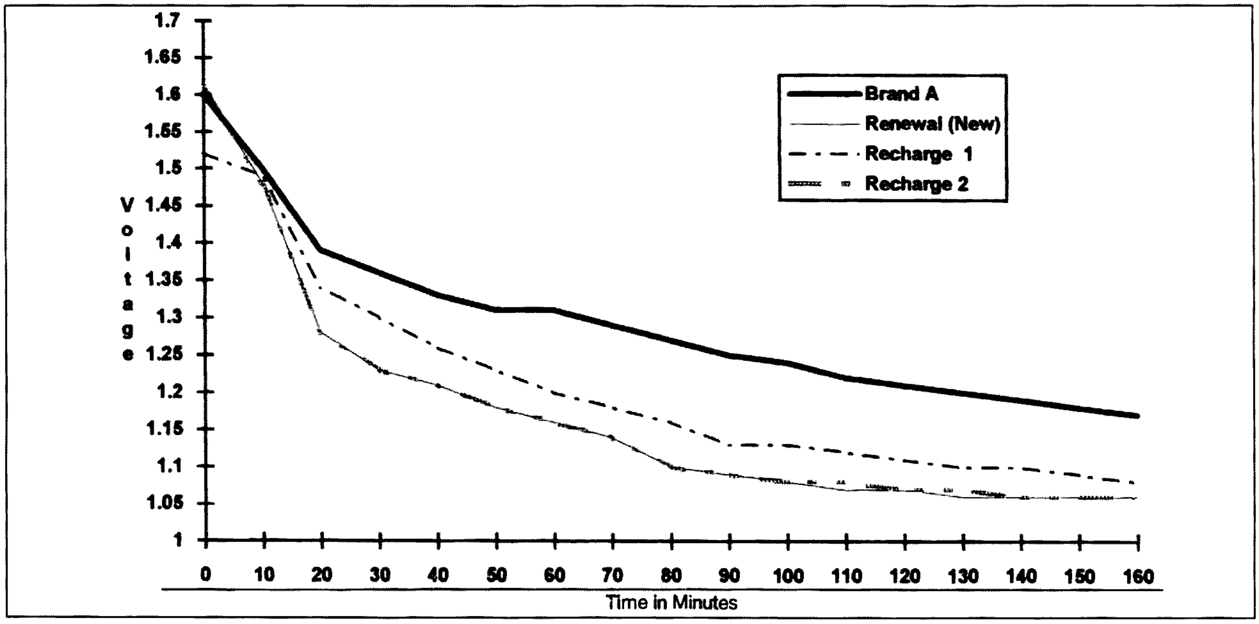


Figure 1. Voltage vs. time curve.

UPDATES

Number 11 on your Feedback card

"Using the World's Most Accurate Frequency Standard, Part 3."

Refer to the above mentioned article in the March 1994 issue, page 18. In the Figure 1 schematic, add C13 (a 0.01 µF cap) between +8V and GND. On the Figure 2 schematic, LED2 and LED3 are shown with reverse polarity.

"ASCII-to-Morse Code Interface"

Refer to the above mentioned article in the February 1994 issue, page 36. An updated version of the program code is available on the *73* BBS: (603) 924-9343. (No change is necessary if you ordered the data disk from the author.) Pins 2 and 3 on the DB-9 Jack J3 are shown swapped: pin 2 goes to "T" and pin 3 goes to "R," as marked on the board. One side of the S3 "KYR SPD" switch should go to ground, not +5V, as shown on the PCB parts placement overlay. Simply run a wire from the switch to an unused ground pad instead.

HAM HELP

Number 12 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2"x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or ı, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

NEEDED: Service manual for the ALINCO ALD-24T mobile transceiver. I will gladly pay the photocopy and shipping cost. Thanks. *Jacques Brodeur VE2EMM, 5034 Joseph Rodier, Montreal Que. H1K 5E1 Canada.*

I need a schematic for SHAKESPEARE GBS 5000 (CB), or info to convert to 10 meters. I will pay for copies and postage. *S. Brzoska N2MHQ, 27 Willow St., Washington NJ 07882.*

WANTED: Service manual/schematic, for JFD Model 7200 Field Strength Meter. *Marvin Moss, Box 28601, Atlanta GA 30358.*

The Rayovac Renewal Battery *Continued from page 40*

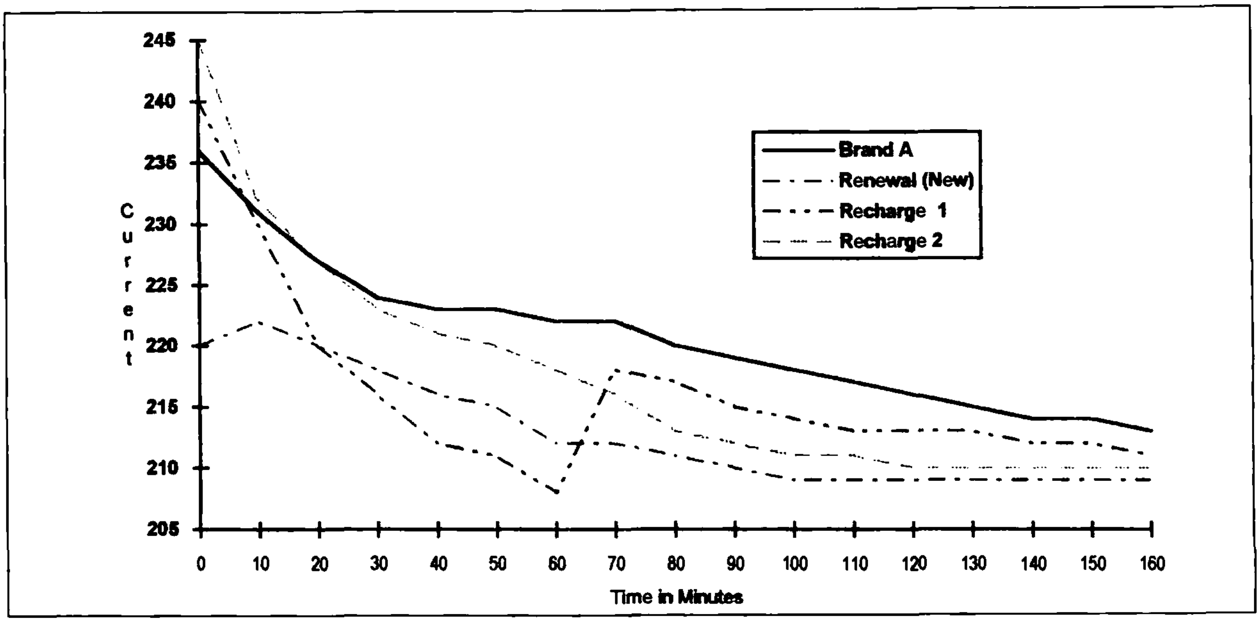


Figure 2. Current vs. time curve.

shape of the performance curves and not the absolute values.

Brand A is actually a compendium of values obtained from several test runs using two different brands of conventional alkaline batteries. The Renewal battery was run through the test new from the package, recharged overnight in a Rayovac Power Station, then tested in this charge/discharge cycle again and again. After several charge-discharge cycles, the test results for the Renewal battery remained essentially the same. The only

Equipment	Voltage	Current Draw	Conditions
Sangean SG-789	4.5 VDC	60 mA	W/O headphones
Shortwave RX		33 mA	W/headphones
Sony 2002	6.0 VDC	60 mA	W/O headphones
Shortwave RX		53 mA	W/headphones
ICOM IC-2AT	9.0 VDC	45 mA	RX squelch off
VHF FM transceiver		265 mA	TX hi pwr.
PRO-38 scanner	7.5 VDC	75 mA	SQ off
Wideband scanner		42 mA	RX normal

Table 1.

anomaly in this series was during the test after the first recharge, when a current spike showed at about an hour into the test. It never occurred again. The data sets obtained from testing multiple Renewal cells are otherwise unremarkable. The Renewal curves compare favorably with the conventional cell.

Table 1 shows some common electronics equipment useful in emergency situations and the amount of current used by that equipment. You may infer performance of the Renewal battery in portable equipment by comparing current draw to test results. In these tests, the Renewal battery produced significant amounts of current (210 mA) even after over two-and-a-half hours of steady draw. The smaller of the two shortwave sets listed in Table 1 only uses 15% of the test current in normal operation. Over 20 hours of full-time operation would still leave the battery with more than 1 volt remaining. When I talked to the folks at Rayovac, one of the technical staff suggested that 1.0 volt would be good as a bench mark for recharging; however, the battery could be run totally "flat" without damage. I drained one cell until no voltage was indicated, then recharged it overnight. It then indicated 1.61 VDC. No damage! This isn't a recommended practice, but if you do it occasionally it won't ruin the battery.

Observations: Renewal batteries exhibit the same performance curve as conventional alkaline cells but their absolute values are somewhat lower. Performance of the Renewal clearly exceeds NiCd cells in the same working environment. The failings (rapid current drop-off, memory effect) of NiCd cells have been amply documented so I won't repeat all of them here. A shelf life at 85% of full charge of over five years and a power density of 1.7 Ah for AA cells is claimed, and I have every reason to believe it.

When a cell recharge is needed, you *must* use the Power Station recharger. This recharger station from Rayovac comes in two flavors: a compact four-cell version for AAA and AA cells and an eight-cell "family" station which can handle AAA to D cells. Both run from 117V AC mains and recharge the cells with a proprietary pulse-current circuit. No provision, as yet, has been made for a 12 VDC charging adapter. A small 200 watt inverter to drive the Power Station would fill the bill for emergency needs until such a time that Rayovac might offer a 12 VDC vehicle charger. *Caution: If your equipment is set up to recharge cells when running from AC mains, remove the Renewal batteries and charge them in the correct charger.* This will save both the cells and your equipment.

The bottom line: The battery pays for itself after the second recharge. Or (using local Anchorage prices) over a mere 25 recharges I can save over $20—per cell! The gravy: There's less in the local waste stream and when the battery does hit the dump—very little hazardous material. I have changed out the batteries in all of my portable equipment and look forward to the savings. So can you!

The Morse Messenger

A tiny, inexpensive CW IDer for foxhunters, balloonists, and tight-fisted hams.

by Scott Edwards KF7VS

Full-featured CW-ID units are great for repeaters and pampered personal radios, but transmitter hunters, balloonists, model rocketeers, and financially challenged hams need a Morse source that is lightweight, rugged, and as close to free as possible. That's the premise behind my Morse Messenger, a CW-ID unit on a chip.

The Morse messenger, though Spartan in design, offers the following features:

•Keying speeds from 7 to 40 wpm, with Farnsworth-style spacing.

•Up to eight messages in permanent read-only memory (ROM).

•Low power consumption—less than 1 mA when idle, about 3 mA while keying (depending on external loads).

•Direct speaker or piezo transducer drive.

•Ability to turn on an oscillator a half second before keying begins to allow it to stabilize, then turn it off after keying is done.

•Low parts count; the chip, two resistors, and a capacitor make a working circuit.

Of course, the chip has its limitations. Its maximum capacity is 92 characters for the total of all eight message slots. The chip can hold one 92-character message, two of 46, etc. Once messages are programmed, they're permanent; callsign changes mean replacing the chip. And the sidetone output is square wave, not sine wave, so it shouldn't be used to modulate a transmitter without thorough filtering or an external sine wave oscillator, as shown in Figure 4. If you can overlook those small faults, you can construct a working CW IDer for less than $15.

How It Works

Figure 1 shows a simple implementation of the Morse Messenger. The IC is a programmed PIC 16C54 microcontroller. The PIC microcontroller is similar to a microprocessor in that it can perform simple computations, comparisons, and logical operations under the direction of a program. But it lacks the data, address, and control busses that a microprocessor uses to manage lots of memory and peripherals. Instead, PICs and microcontrollers in general have input/output (I/O) ports that allow them to sense levels and switch small loads.

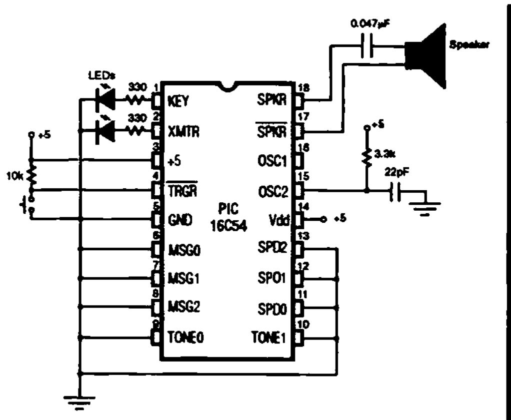
The PIC is different from common microcontrollers in that it is *fast, simple,* and *cheap. Fast* means five million instructions per second at the highest clock speed of 20 MHz. To reduce power consumption, the Messenger runs at about 4 MHz. *Simple* means that the chip is a reduced instruction set computer (RISC) device. It is optimized for common operations (such as moving data or comparing two values), and doesn't support some obscure operations at all. *Cheap* means that mail-order dealers carry unprogrammed PIC 16C54s for about $6. The low price is due in part to the fact that these chips cannot be erased. The window that allows erasure with ultraviolet light is apparently a significant part of the cost of making chips; an erasable PIC 16C54 is about $16.

Figure 2 outlines the program that turns a garden-variety PIC into a Morse Messenger. The nut of the program is the method for storing the Morse characters as single bytes of data, and the routine for decoding these bytes.

The basic encoding scheme is simple. The lower three bits of a byte represent the number of elements (dits and dahs) in the character. Three bits can express the numbers 0 through 7, and since the Morse characters of interest have between one and six elements, that's a good fit. The upper five bits represent the pattern of dits and dahs. A 0 is a dit and a 1 is a dah.

The letter F (dididahdit) encodes as 0010x100. The value of bit x doesn't matter, because the lower three bits stipulate that this character has four (100 binary) elements.

Things become stickier with six-element characters. Only five bits are available to stand for individual dits and dahs, so we have to borrow some excess capacity from the lower three bits. If the lower three bits total six (110 binary), the program interprets the byte as a six-element character ending in dit. If the lower three bits total seven (111 binary), it's still a six-element



Set up as shown, the chip will play message no. 0 at 7 words per minute, lowest sidetone frequency (400 Hz). LEDs indicate oscillator warmup (XMTR) and keying (KEY).

MSG2	MSG1	MSG0	Message No.
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

TONE1	TONE0	Sidetone (Hz)
0	0	400
0	1	525
1	0	650
1	1	775

SPD2	SPD1	SPD0	Speed (WPM)
0	0	0	7
0	0	1	10
0	1	0	15
0	1	1	20
1	0	0	25
1	0	1	30
1	1	0	35
1	1	1	40

Figure 1. Simple hook-up diagram for the Morse Messenger chip. The table indicates the range of messages, sidetones, and keying speeds.

character, but ends in dah.

The accompanying table shows how numbers, letters, and punctuation are stored in the PIC's ROM according to their ASCII values. This is a convenient arrangement, since messages are stored as ASCII strings. When the chip keys a message, it looks up the first ASCII character, matches it to a Morse pattern, sends the corresponding dits and dahs, and proceeds to the next message character until the message is complete.

Now that we've looked at the internal details of the chip, let's see how this translates to a black-box view. According to Figure 1, if you tie all of the message, sidetone and speed lines to ground, you are asking the chip to send message number 0 (of 0 through 7) at 7 wpm with a sidetone of about 400 Hz. Connect a small speaker to the SPKR output and LEDs to the XMTR and KEY outputs as shown in Figure 1. Apply power, then press and release the switch. Immediately after you release the switch, the XMTR LED lights. About 0.5 seconds later, the KEY LED begins flashing in time to message 0, while the speaker sings along. As soon as the message is finished, the speaker falls silent and both LEDs go out.

In a real application, XMTR energizes an oscillator and allows it to stabilize for a half second before transmission begins. When the transmission is over, the oscillator shuts down to conserve power. If the oscillator draws 20 mA or less, the XMTR pin can power it directly. This feature is aimed squarely at flea-power uses like foxhunt beacons.

To play other messages, connect the appropriate pins to +5 and ground. For example, Figure 1 says message 6 is 110, so connect pins 8 and 7 to +5, and ground pin

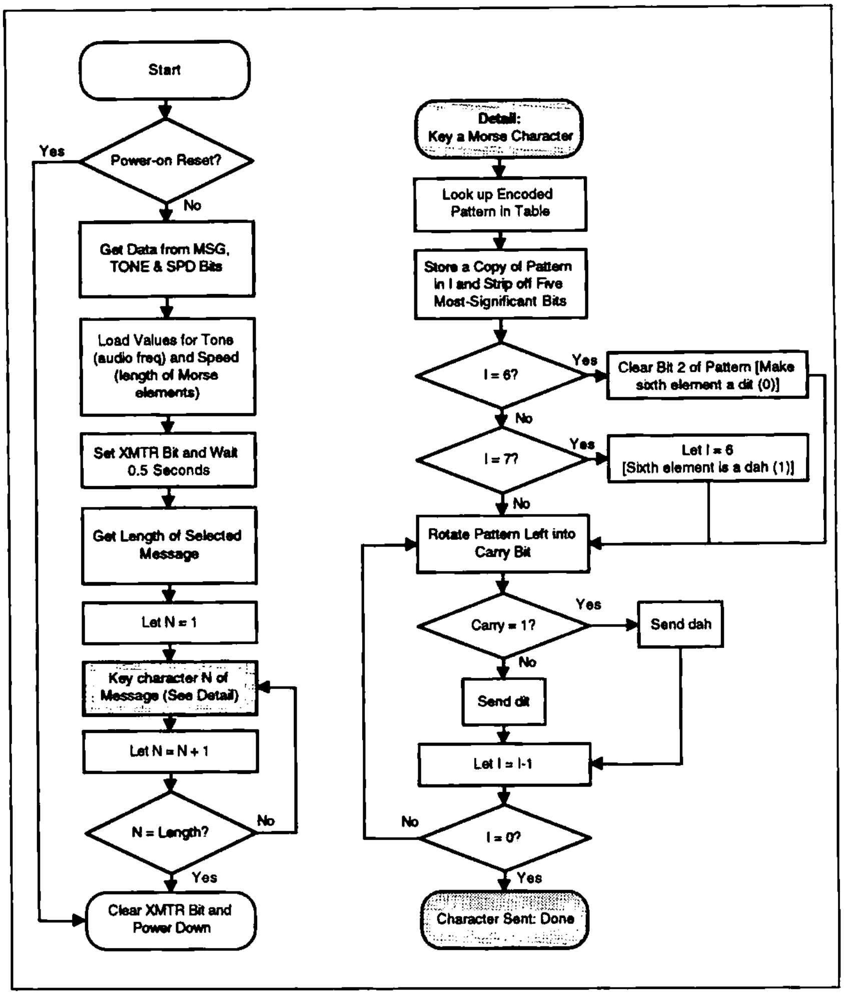


Figure 2. Logic of the Morse Messenger's program. This algorithm can be adapted to other devices with the help of the Morse encoding table.

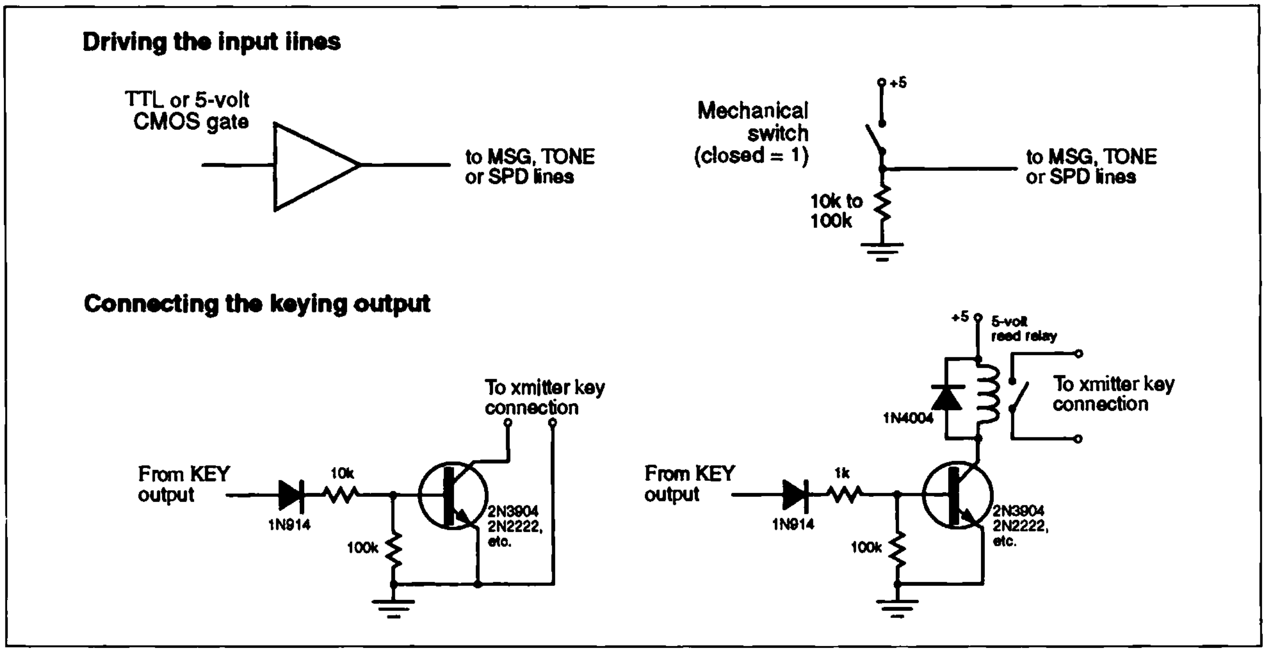


Figure 3. Suggested input and output connections for the Morse chip.

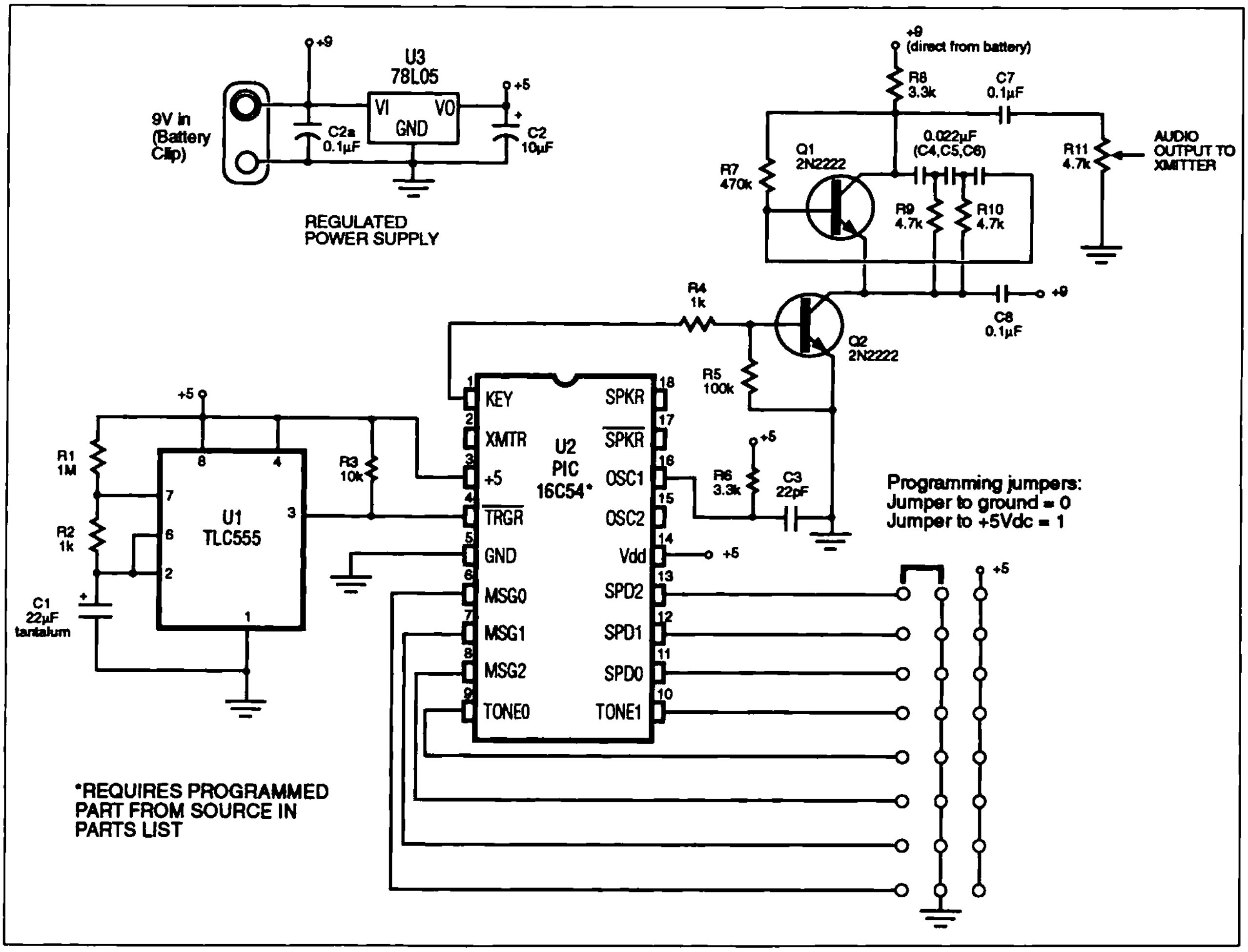


Figure 4. Foxhunt keyer with sine audio output. It sends its beacon every 15 seconds with the parts shown. Larger values of C1 will increase the interval between messages.

Parts List for Figure 4, The Morse Messenger Fox Modulator

Semiconductors		
U1	TLC 555 CMOS Timer	Radio Shack 276-1718
U2	Programmed PIC 16C54	See Note for source
U3	78L05 100 mA, 5 volt positive regulator	Digi-Key AN78L05
Q1,Q2	2N2222 (or similar) NPN transistor	Radio Shack 276-2009
Resistors (All are 1/8W, 5%, unless otherwise noted.)		
R1	1,000,000 ohms	
R2,R4	1,000 ohms	
R3	10,000 ohms	
R5	100,000 ohms	
R6,R8	3,300 ohms	
R7	470,000 ohms	
R9,R10	4,700 ohms	
R11	4,700 ohm trimpot	Radio Shack 271-281
Capacitors		
C1	22 µF 15 WVDC tantalum	
C2	10 µF 15 WVDC tantalum	
C3	22 pF ceramic disc	
C4,C5,C6	0.022 µF ceramic disc	
C2a,C7,C8	0.1 µF ceramic disc	

Note: The programmed PIC 16C54 is available from Scott Edwards KF7VS, 964 Cactus Wren Lane, Sierra Vista AZ 85635. Send $12 check or money order and your typed or neatly printed list of eight messages. Be sure that the total number of characters, including spaces, does not exceed 92. A circuit board for the foxhunt modulator is also available for $5.

For more information on PICs and inexpensive tools for programming them, contact Parallax, Inc., 3805 Atherton Road No. 102, Rocklin CA 95765; Telephone: (916) 624-8333.

6. The same goes for changing sidetones and speeds. Note that you don't have to connect any of these pins directly to the power rails as shown. You can also connect them to +5 volts or ground through fairly large resistors (up to 100k), or tie them to the outputs of logic gates shown in Figure 3.

Figure 4 is a complete audio keying circuit for a foxhunt transmitter modulator based on the Morse Messenger. The circuit is designed to operate from a standard 9 volt battery. With the parts values shown, it transmits a brief message every 15 seconds.

The message, tone, and speed are programmed by installing jumpers between the pins of U2 and ground (0) or +5 volts (1). If you need the ability to reprogram the unit in the field, substitute header stakes for the jumpers and use shorting blocks to make the connections.

As for the rest of the circuit, transistor Q1, capacitors C4 through 6, and resistors R7 through 10 comprise a sine wave oscillator for tone-modulated Morse. Transistor Q2 serves as a switch, while C8 filters key clicks.

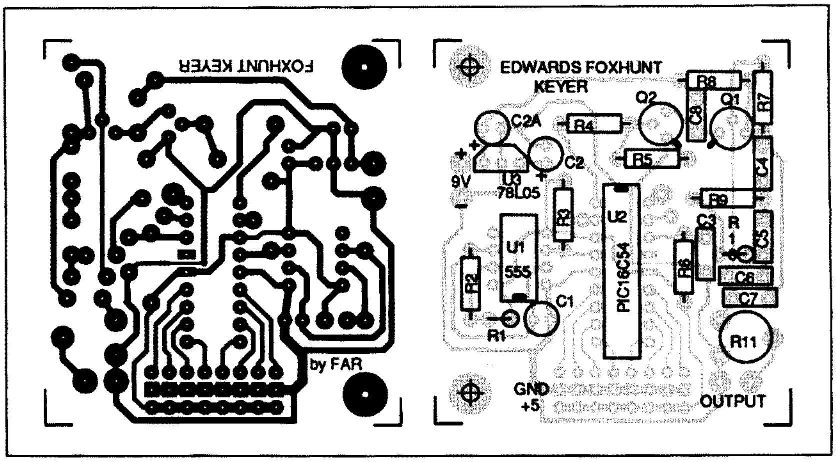


Figure 5. The Morse Messenger Foxhunt Modulator PC board is available for $5 from the author.

Other hams are hard at work on their own applications for the Messenger chip. Steve Jackson KZ1X plans to incorporate it into a foxhunt transmitter, an auto-IDer for HF operation, and the University of North Carolina bicentennial special events station as a beacon. Tom Brown KJ5IE is building it in to an off-air tune-up keyer, a "lowfer" (160 to 190 kHz experimenter band) beacon, a U.S.-to-Australia propagation beacon, and for some future moonbounce experiments. I'm sure you can think of a few uses for this cheap, versatile Morse source too.

Table of ASCII Characters with Morse and Binary Morse Equivalents

Character	ASCII	Morse	Binary Encoding	Decimal Encoding	Remarks
<space>	32		00000000	0	7 dits of silence
!	33		00000000	0	sent as <space>
"	34	•–••–•	01001110	78	
#	35	•••–•–	00010111	23	Morse $\overline{\text{SK}}$
%	36	•••–••–	00000000	0	sent as <space>
$	37		00000000	0	sent as <space>
&	38		110011111	207	sent as comma
'	39	•––––•	01111110	126	
(	40	–•––•	10110101	181	
)	41	–•––•–	10110111	183	
*	42		00000000	0	sent as <space>
+	43	•–•–•	01010101	85	Morse $\overline{\text{AR}}$
,	44	––••––	110011111	207	
-	45	–••••–	10000111	135	
.	46	•–•–•–	01010111	87	
/	47	–••–•	10010101	149	
0	48	–––––	11111101	253	
1	49	•––––	01111101	125	
2	50	••–––	00111101	61	
3	51	•••––	00011101	29	
4	52	••••–	00001101	13	
5	53	•••••	00000101	5	
6	54	–••••	10000101	133	
7	55	––•••	11000101	197	
8	56	–––••	11100101	229	
9	57	––––•	11110101	245	
:	58	–––•••	11100110	230	
;	59	–•–•–•	10101110	174	
<	60		00000000	0	sent as <space>
=	61	–•••–	10001101	141	Morse $\overline{\text{BT}}$
>	62		00000000	0	sent as <space>
?	63	••––••	00110110	54	
@	64		00000000	0	sent as <space>

Character	ASCII	Morse	Binary Encoding	Decimal Encoding
A	65	•–	01000010	66
B	66	–•••	10000100	132
C	67	–•–•	10100100	164
D	68	–••	10000011	131
E	69	•	00000001	1
F	70	••–•	00100100	36
G	71	––•	11000011	195
H	72	••••	00000100	4
I	73	••	00000010	2
J	74	•–––	01110100	116
K	75	–•–	10100011	163
L	76	•–••	01000100	68
M	77	––	11000010	194
N	78	–•	10000010	130
O	79	–––	11100011	227
P	80	•––•	01100100	100
Q	81	––•–	11010100	212
R	82	•–•	01000011	67
S	83	•••	00000011	3
T	84	–	10000001	129
U	85	••–	00100011	35
V	86	•••–	00010100	20
W	87	•––	01100011	99
X	88	–••–	10010100	148
Y	89	–•––	10110100	180
Z	90	––••	11000100	196

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Thousands of amateurs have discovered that chasing satellites can be addictive. Many hams with walls full of QSLs and operating certificates have found renewed enthusiasm for their hobby through contacts via the amateur radio satellites and pursuing awards in recognition of their efforts. Several organizations and amateur radio magazines promote operating activities and certificates for interested hams. AMSAT, the Radio Amateur Satellite Corporation, has several intriguing awards and exercises worth seeking.

The AMSAT Awards Program

Over the years, AMSAT has promoted certificates to commemorate special events like the launch of AMSAT-OSCAR-10, the commencement of AMSAT-OSCAR-13 operations, donations for satellite solar cells, the 20th anniversary of the launch of OSCAR-1, the Stoner Challenge Cup Competition, and additional events. Further programs recognizing long-term activities were begun two decades ago and continue today.

The AMSAT Awards Program provides several awards designed specifically for the satellite enthusiast. The first was the Satellite Communicators' Club (SCC) certificate, started in 1973 after AMSAT-OSCAR-6 was safely in orbit. The intention of this program was to document the use of A-O-6 and to promote activity. Two years later AMSAT announced a new award, the OSCAR Satellite Communications Achievement Recognition (AOA) certificate. Earl Skelton WA3THD coordinated the program for four years. During that time two other awards were added, the OSCAR Sexagesimal Award and the OSCAR Century Award. Jim Devilbiss WA3FUJ accepted the responsibilities of the Award Manager position from July 1979 until late 1986 when Andy MacAllister WA5ZIB took over the post. Mike Scarcella WA5TWT accepted the job responsibilities in late 1992 and is the current AMSAT Award Manager.

Satellite Communicators' Club

Just as with the low-band awards, some of the satellite certificates are more difficult to earn than others. Only a single satellite contact is sufficient to qualify for the Satellite Communicators' Club certificate. The original certificate had a drawing of AMSAT-OSCAR-6 in the lower left. It was announced in "Satellite Operating Awards" by Ray Soifer W2RS in the June 1973 *AMSAT Newsletter*. Today's version of the award shows a Phase-3 style satellite in the lower right corner (Figure 1). The printing is dark blue on light-gray textured paper. To receive the award, send a report of a two-way contact through any amateur satellite to the AMSAT S. C. C. Manager, P.O. Box 27, Washington, DC 20044. No form is necessary, and submission of a QSL is not required. Pertinent information about the QSO, along with a self-addressed stamped envelope (S.A.S.E.) and $1 ($2 for non-AMSAT members) should be submitted. Walt Rader WA3DMF handles this program.

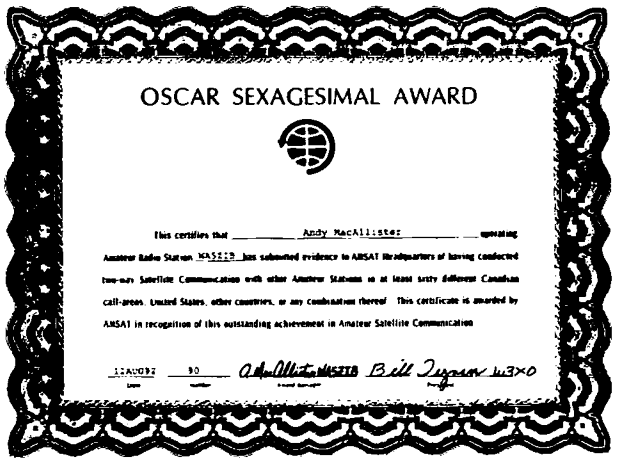


Figure 3. The OSA is issued for 60 qualified satellite contacts.

OSCAR Satellite Communications Achievement Award

Originally known as the OSCAR Satellite Communications Achievement Recognition, the OSCAR Satellite Communications Achievement Award (renamed in 1992) is also known as the AMSAT OSCAR Award, or AOA. This accomplishment requires proof of 20 qualified satellite contacts. A qualified QSO is one with a different state, Canadian call area or DXCC country, in any combination. Endorsements for each 10 QSOs above 20 are available only for those with certificates dated prior to 1992, when the certificate was updated (Figure 2). The printing is black on beige textured paper. The cost of the award is $3.50 for AMSAT members and $5 for nonmembers. Applicants should include copies of QSL cards or copies of other acceptable proof of contacts (ARRL W.A.S., DXCC, etc.) and return postage. It is preferable not to send original QSLs.

OSCAR Sexagesimal Award

The program for the OSCAR Sexagesimal Award, or OSA, began in 1976 in response to the many endorsement sticker requests for the basic AOA. To receive the OSA, communication with 60 qualified stations is required. Costs and contact constraints are identical to the easier award. Less than 200 applications are on file for the OSA. The certificate (Figure 3) is printed in black on off-white parchment.

OSCAR Century Award

The OSCAR Century Award represents another grade of difficulty beyond the OSA. This award requires 100 qualified contacts via satellite. In 1978 the cost was $5 for members. Today it is the same as the AOA and OSA, i.e. $3.50 for members and $5 for nonmembers. Less than 50 stations have applied for and received the OCA. The certificate (Figure 4) is printed in black on off-white parchment, with the AMSAT logo in red.

SA AMSAT Satellite Communication Achievement Award

Countries besides the United States also promote awards. South Africa AMSAT sponsors their Satellite Communication Achievement Award for making 25 two-way contacts through Phase-II satellites. Presently, that would include all RS (Russian hamsats), A-O-21, A-O-27 and Fuji-OSCAR-20 activity. A-O-10 and 13

Figure 1. The Satellite Communicators' Club certificate is available for proof of one satellite QSO.

Figure 2. AMSAT's basic award, originally known as the AOA, is available for proof of 20 "qualified" satellite QSOs.

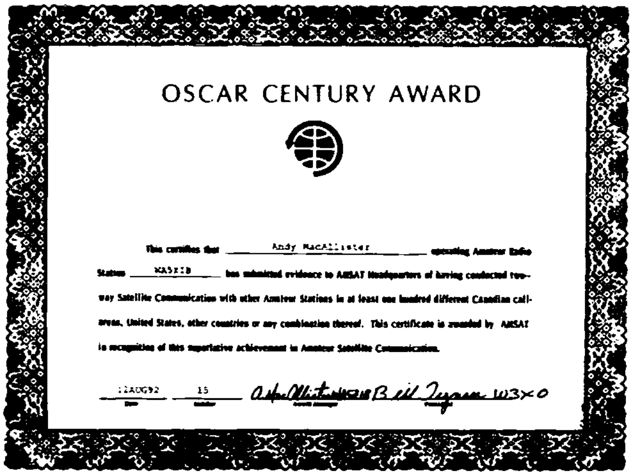


Figure 4. The OCA is available for 100 qualified satellite contacts.

Figure 5. This South Africa AMSAT award is available through AMSAT-NA for proof of contact with 25 stations via low-orbit hamsats.

(Phase-3) contacts are not allowed. The SA AMSAT award is available through AMSAT NA for the usual $3.50 for members and $5 for non-members. The certificate (Figure 5) is signed by the SA Awards Manager, Andre Botes ZS2ACP (ex ZR2FK).

The K2ZRO Memorial Station Engineering Award

The K2ZRO Memorial Station Engineering Award Program, or just "ZRO Test," was begun seven years ago by Vern Riportella WA2LQQ via AMSAT-OSCAR-10. This technical achievement activity via satellite honors the memory of Kaz Deskur K2ZRO. Kaz was known in satellite circles for his invention of the Satellabe OSCAR tracking calculator and his active participation in hamsat pursuits since the early days of A-O-6. The purpose of the competition is to promote operating skill and receiver performance by testing the listening capabilities of individuals monitoring the transmissions of a control station through the satellite transponder. The program continues today through the mode "B" (70-cm uplink and 2 meter downlink) transponder of AMSAT-OSCAR-13. Test coordinators during the last seven years have included WA2LQQ, WA5ZIB, W6HDO and N5EM.

Test sessions are scheduled for periods when the satellite is positioned for optimum spacecraft antenna pointing angles with respect to all earth-bound listeners. To provide consistency between tests, the best periods are usually near apogee with the satellite pointed directly at the center of the earth's disc.

During a test, which runs approximately 25 minutes, the control station will begin the event by matching his downlink signal to the level of the general beacon. After a short 10-word-per-minute message announcing the test, the numeric code groups begin. A random five-digit number is sent three times at the beacon level, level Z0. The control station will then pause and cut the uplink power in half (-3 dB) for a new random number at level Z1. The process continues to ZA at 30 dB below the beacon.

The 30 dB decrease in uplink power is the result of cutting output power in half nine times. At the control station for Mode "B" tests, it is typically the difference between 25 watts out at Z0 and 25 mW out at ZA to a 13 dB gain antenna. Although several hams have copied the signals at Z9 (27 dB down), only one, Darrel Emerson AA7FV, has successfully copied the level "A" signals. At this level the uplink system is equivalent to a handie-talkie running one-half watt through a quarter-wave whip.

The ZRO Test certificate is off-white parchment with dark blue printing and the AMSAT logo in red. It has positions for 16 endorsement stickers, eight for mode "B" silver stickers and eight for mode "L" gold stickers. Due to the demise of the Mode "JL" transmitter a few years ago, the "L" stickers are no longer offered. The addition of a Z9 endorsement was not envisioned when the program was created in 1985. Since there was little room on the certificate for much else without marring one of AMSAT's finest awards, a new enhancement to the ZRO program was created, the Z9 Club. For those who qualify, there is a special individualized certificate (Figure 7). Darrel got a plaque at the 1993 AMSAT-NA Space Symposium and Annual Meeting for his level "A" copy. He also presented a paper in the conference proceedings entitled "Digital Processing of Weak Signals Buried in the Noise."

Test schedules are announced via the AMSAT nets. Reception reports can be sent to WA5ZIB at 14714 Knightsway Dr., Houston, TX 77083. A reply will be sent verifying the lowest level copied. The cost of the basic award is $3.50 for members and $5 for nonmembers. All certificate requests should be sent directly to WA5ZIB. Checks should be made out to AMSAT. Foreign participants are encouraged to include additional funds to cover airmail postage.

The AMSAT Awards Program has been active since the launch of A-O-6. Emphasis in recent years has been on the ZRO Tests, but all of the earlier awards, the SCC, AOA, OSA, OCA and the South African version of the AOA, are still available and make excellent additions to any station. Work continues to update the program. A new advanced award is under study requiring a minimum of 1000 QSOs via satellite. Sounds like a lot? It really isn't when you're into the hamsats.

Figure 6. The ZRO test certificate has room for quite a number of endorsement stickers.

Figure 7. A special individualized certificate is available for those who copy level 9 of a ZRO test via A-O-13.

RTTY LOOP

Number 15 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

I don't know anything more near and dear to an amateur's heart than looking for that next contact. We build equipment, run cables, stay up late and disrupt our spouses, parents, or neighbors, all in search of that elusive QSO. We are looking for conversation, information, or just a place to spout off. Ham radio started off with long waves and spark, and has progressed to tiny little short waves with audio, video, and digital information. For many of us, some of what we do isn't even on the air!

Over the past few years I have ended this column with the notation that I am available on a number of computer data services, and many of you have taken advantage of that fact to reach me. Well, now there is a new venue in town, one which is designed just for us.

Delphi, one of the most affordable computer services, has opened a "Radio SIG" which features amateurs at the helm, and multiple databases of interest to amateurs, CBers, and SWLs.

Marty Goodman KC6YKC, who was a great help in getting the Radio Shack Color Computer onto RTTY some years back, was instrumental in starting this special interest group. Marty told me that, in the past, ham radio in particular, and radio hobby stuff in general, has been handled on Delphi as a subtopic within the HOBBY SIG, founded by Charles Bachand (BACHAND on Delphi). Charles actually amassed a fair amount of ham-related files of interest for the database in that topic area.

About two years ago or so, Andy Eddy WB1FNV (VIDGAMES) approached the Delphi management regarding the possibility of setting up a separate ham radio SIG. At that time the suggestion could not be implemented.

About a year ago, Marty was brought in as a SIGop for the HOBBY SIG's Ham Radio topic area by Charles Bachand, after the two had become acquainted in the computer arena.

Marty, not knowing of Andy's earlier efforts, then approached Delphi about setting up a ham radio SIG, but again the idea bore no fruit. Then, about nine months ago or so, Andy approached Marty and told him that Delphi had indicated that the two of them could receive approval for a jointly-founded ham radio SIG.

Both of these gentlemen had extensive experience in computer SIGs. Andy has about four years' experience managing SIGs on Delphi, having been the manager on the Delphi Atari SIG, and on the World of Video Games SIG. Marty has about 10 years experience with the CoCo and OS9 SIGs on Delphi.

Unfortunately, Delphi was undergoing growth pangs at the time the new SIG was planned, and the anticipated SIG has taken a bit of time to see the light of day. Called the "Radio SIG," it supports a variety of radio hobbyists in addition to ham radio types: SWL DXers, scanner users, CB users, and satellite TV users. Even the few broadcast radio types seen on the Hobby SIG are welcome.

Within a couple of weeks of the opening of the service, over a thousand people have visited the SIG. The forum will have seen nearly a thousand messages in the first six weeks of the SIG's existence. As of this writing, there are over 300 groups of files in the data base, with new files being added daily. Of special interest to hams is a plethora of files detailing radio modifications, gleaned from the best available sources. The Radio SIG has established a cordial relationship with *Newsline*, and each week's *Newsline* is posted regularly.

Data bases available on the Radio SIG include:

- General Information
- VHF/UHF Ham
- HF Ham
- Listening
- Hardware Mods
- ARRL
- Vendors/Reviews
- Packet Radio
- New Arrivals

Under each of these topics are hundreds of files, arranged into groups, on a wide variety of topics. Packet and RTTY programs, equipment reviews, service bulletins, clock programs, and other assorted goodies are yours for the downloading. There is a good likelihood that the programs of the various "RTTY Loop" collections will show up there as well.

To join Delphi, call Delphi Member Services at 1-800-695-4005, or at (617) 491-3393 from within Massachusetts or outside the United States. I mentioned at the beginning of this column that Delphi is affordable. Well, there are two package plans for joining Delphi: the 10/4 Plan, and the 20/20 Advantage Plan. The 10/4 Plan, at $10 per month, includes the first four hours of use each month. Additional use is $4 per hour (actually billed as 6.6 cents per minute). The 20/20 Advantage Plan, at $20 per month, includes the first 20 hours of use each month. Additional use is $1.80 per hour. There is a one-time enrollment fee of $19 for this second plan (discounted if chosen during the first month).

Just to further interest you, the Radio SIG is not the only special interest group of note on Delphi. Here is a listing of the full "Groups and Clubs" menu:

- Aviation Sig
- Business Forum
- Close Encounters
- Golf SIG
- Custom Forums
- Environment SIG
- GameSig
- Hobby Shop
- Languages and Cultures
- MensNet
- Music City
- New Age Network
- Person to Person
- Photography & Video
- Radio SIG
- Science Fiction Sig
- Senior Forum
- Sports Connection Online
- Theological Network
- TV/Movie Group
- USA Gymnastics
- WCF—World Community
- WIDNet-Disability Network
- Yachting SIG
- World of Video Games
- Writers Group

Of course, that's not all—there are also a bunch of entertainment and game services, reference and education, shopping, news, and travel services. Delphi is even interfaced with Internet, and can both port to Internet and be reached from Internet.

All in all, Delphi (which, by the way, is accessed with any simple text-based terminal for its menu driven interface) may represent the best hidden value in computing today. Give them a call, and let them know that you read about it here, in *73*'s "RTTY Loop." And see you on the Radio SIG!

Of course, for any of you who just can't wait, the now-five disks of RTTY and affiliated software remain available from the above address. Send sufficient media (each collection fits on a 3.5" 1.44 Mb HD disk), $2 for each disk to be filled, and a stamped self-addressed return mailer, specifying the collections desired. A stamped, self-addressed envelope sent to me will get you a listing of the directories of the collections. As always, I look forward to your comments and questions both by SnailMail and Email. The latter to me on CompuServe (75036,2501), Delphi (MarcWA3AJR), or America Online (MarcWA3AJR). Internet users, please direct Email to me via marcwa3ajr@aol.com—it seems to be the fastest route overall.

We have reviews of a couple of commercial packages in the pipeline, with more on the shareware scene as well. All this as next month begins the 18th year of RTTY Loop!

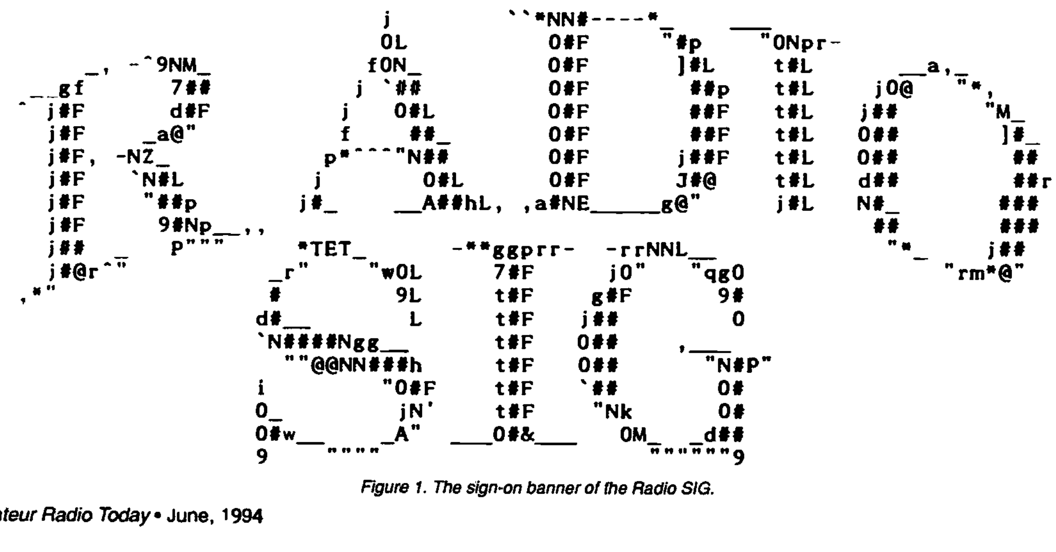


Figure 1. The sign-on banner of the Radio SIG.

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Circuit Design Software for Hams

Reviews of the Z-Match for Windows and Analyser III Software

Some months back I reviewed a printed circuit layout and schematic drawing program called Easy-PC by a company called Number One Systems, Ltd. of England. I use that program to design the printed circuit boards you see in this column from time to time. That program was so useful to me that I obtained copies of two more programs from the same company: Analyser III and Z-Match for Windows; both programs are reviewed here . . . and I'm impressed.

First, the company, Number One Systems, Ltd. is British, but they have a U.S. office (which often advertises in *73*). The addresses for the company are:

England	Harding Way Somersham Road St. Ives, Huntingdon Cambridgeshire, England PE17 4WR Phone from USA: 011-44-480-461778
USA	1795 Granger Avenue Los Altos CA 94024 Phone: (415) 968-9306

Now let's take a look at the programs.

Z-Match for Windows

Anyone who designs RF circuits rapidly comes to the Smith chart, one of several charts developed in 1939 by Phillip Smith of Bell Labs. The Smith chart is often viewed by amateurs as somewhat daunting to use because it is tedious to construct. The Z-Match program makes that chore easy.

Figure 1 shows the impedance form of the Smith chart, while Figure 2 shows the admittance form of the chart. The program shows the Smith chart display on-screen. It will do admittance-impedance conversions, lumped L and C circuits, transmission line problems, is an S-parameter calculator, and has a host of other features. It solves problems involving RF transistors, complex LC networks, impedance matching networks, and transmission lines. It accounts for line losses, dielectric losses, velocity factor, frequency and characteristic impedance, and gives solutions in terms of standing wave ratio (SWR), reflection coefficient (b), actual line length and component values. Because I am interested in antennas, I plan to use Z-Match quite a bit in my playing around with new things.

Hardware required to run Z-Match for Windows is any Windows-compatible machine using a 286 or later processor (e.g. 386, 486, Pentium). It needs to see Windows 3.0 or later. However, one might find that performance on 286 machines suffers a bit. However, on both my 386 machine and 486 machine it ran well and worked splendidly. It requires 1 mbyte of free memory space on the hard drive. Otherwise, the system requirements are modest.

Analyzer III

The Analyser III software is MS-DOS based, and will run in either the DOS 3.0 (or later) or Windows environments. Under DOS, one enters "AN3" to start the program. Under Windows I run the program from the File Manager option (Windows Set-Up did not recognize Analyzer III, which is not uncommon for a DOS-based program). The program will run on machines not equipped with a hard drive, but because there are exchanges to the disk, using a floppy will slow things down a bit. Any processor from 8088 through 486 will run the program. RAM memory required is 640K.

Analyser III is used to analyze linear circuits, including filters, amplifiers, crossover networks, wideband

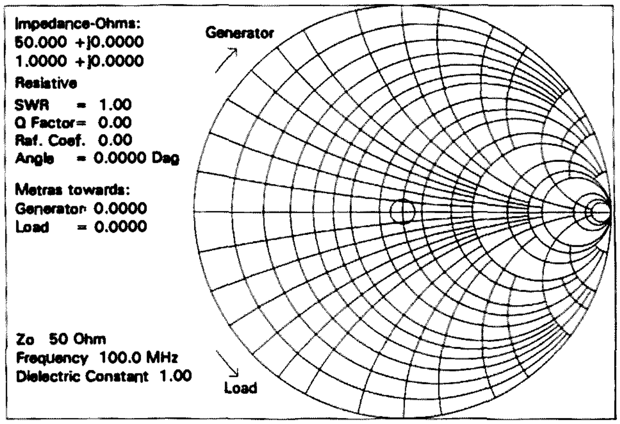


Figure 1. Impedance Smith chart graph from Z-Match.

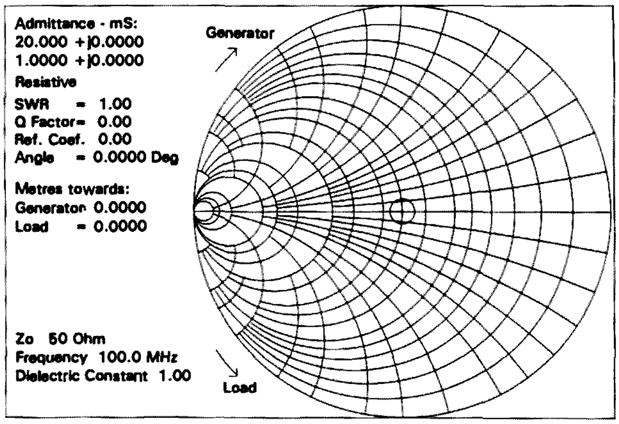


Figure 2. Admittance Smith chart graph from Z-Match.

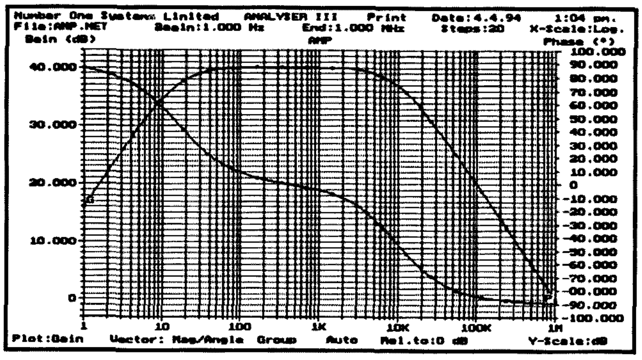
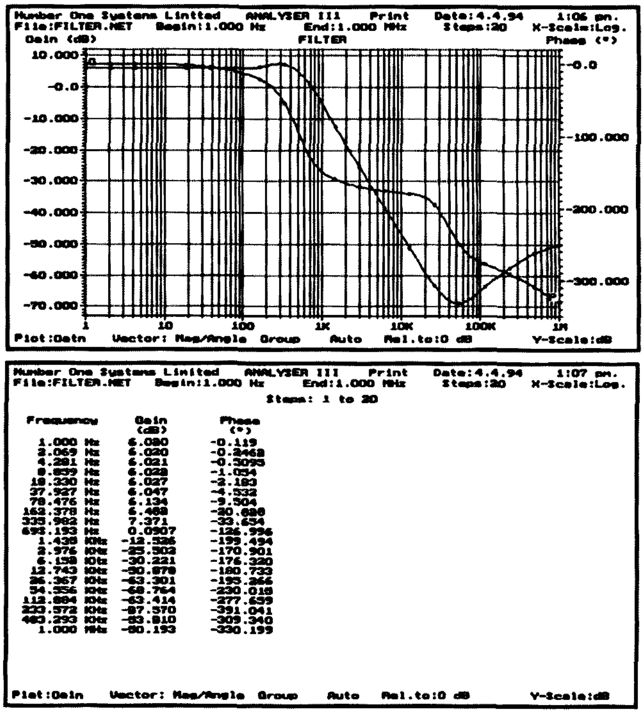


Figure 3. Gain and phase responses vs. frequency plot for an op-amp noninverting follower from Analyser III.



Frequency	Gain (dB)	Phase (°)
1.000 Hz	6.020	-0.119
2.069 Hz	6.020	-0.2462
4.281 Hz	6.021	-0.3095
8.859 Hz	6.022	-1.054
18.330 Hz	6.027	-2.183
37.927 Hz	6.047	-4.532
78.476 Hz	6.134	-9.504
162.378 Hz	6.468	-20.680
335.982 Hz	7.371	-33.654
695.193 Hz	0.0907	-126.996
1.438 KHz	-12.526	-199.494
2.976 KHz	-25.302	-170.901
6.158 KHz	-30.221	-176.320
12.743 KHz	-50.878	-180.733
26.367 KHz	-63.301	-195.266
54.556 KHz	-68.764	-230.018
112.884 KHz	-63.414	-277.659
233.572 KHz	-87.370	-391.041
483.293 KHz	-83.810	-309.340
1.000 MHz	-80.193	-330.199

Figure 4. A) Gain and phase responses vs. frequency plot for an op-amp Sallen-Key filter from Analyser III; B) Numerical readout of same data as in Figure 4A.

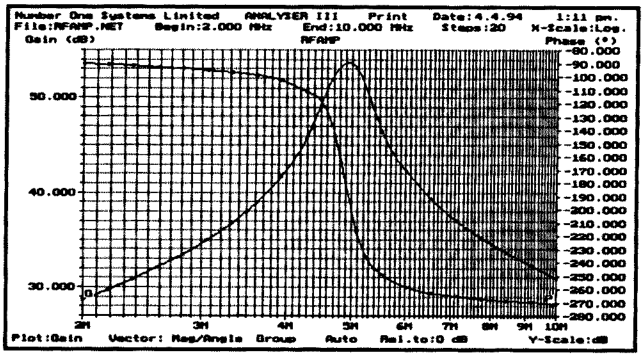


Figure 5. Gain and phase vs. frequency plot for a 5 MHz RF amplifier from Analyser III.

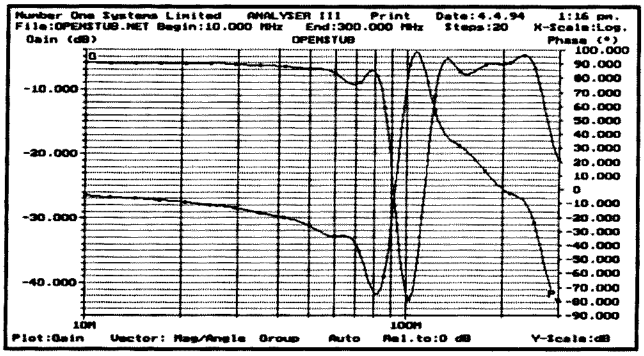


Figure 7. Open transmission line stub gain and phase plot from Analyser III.

Number One Systems Limited ANALYSER III Print Date:4.4.94 1:13 pm.
File:RFAMP.NET Begin:2.000 MHz End:10.000 MHz Steps:20 X-Scale:Log.
Steps: 1 to 20

Frequency	Gain (dB)	Phase (°)
2.000 MHz	28.611	-90.634
2.177 MHz	29.672	-91.266
2.369 MHz	30.808	-92.144
2.579 MHz	32.042	-93.021
2.807 MHz	33.407	-94.048
3.055 MHz	34.949	-95.209
3.325 MHz	36.745	-96.960
3.619 MHz	38.922	-99.323
3.939 MHz	41.725	-103.196
4.287 MHz	45.673	-111.130
4.666 MHz	51.862	-126.424
5.078 MHz	55.058	-216.523
5.527 MHz	46.307	-249.056
6.016 MHz	42.273	-258.250
6.547 MHz	39.227	-262.878
7.126 MHz	37.066	-265.285
7.756 MHz	35.215	-267.112
8.442 MHz	33.632	-268.529
9.188 MHz	32.240	-269.712
10.000 MHz	30.982	-270.755

Plot:Gain Vector: Mag/Angle Group Auto Rel.to:0 dB Y-Scale:dB

Figure 6. Numerical data for the plot of Figure 5.

amplifiers, antenna matching networks, RF/IF amplifiers, video/TV circuits, linear IC circuits, transistor circuits, and other networks operating in the range 0.001 Hz to 10 GHz.

You can use either one of the circuits or devices in the library supplied with the program, or build your own network and enter it into memory as a new library item.

The first screen after the opening will have a menu bar along the type, and one of the options is the File. From this menu (which can be clicked with a mouse or accessed with the "F" key) select "Load a Circuit." A window opens, and lists a number of .NET files from the library. Once the file is loaded, the frequency response plot appears on the screen. You can also select a numerical listing of circuit parameters.

Figure 3 shows the circuit for a universal operational amplifier in the non-inverting follower configuration. Two curves are plotted in Figure 3: frequency response and phase (in degrees). The horizontal axis is a logarithmic frequency scale running from 1 Hz to 1 MHz. The left vertical axis is gain in decibels (dB), while the right vertical axis is phase in degrees from -100 to +100 degrees. The gain curve shows about 40 dB gain at mid-band, falling off below 30 Hz and above 4 kHz. Parameters are calculated at 20 points within the frequency range.

Figure 4 shows the plot for a Sallen-Key filter with a gain of two, and a cut-off frequency of about 500 Hz. The horizontal frequency scale is the same 1 Hz to 1 MHz logarithmic scale as before. The left vertical scale is gain in dB, while the right scale is phase from 0 to -300 degrees. Again, 20 points are calculated. A numerical printout of the same data is shown in Figure 4.

The plot for an RF amplifier is shown in Figure 5. The horizontal scale is frequency from 2 MHz to 10 MHz. The frequency scale is logarithmic, although that may not be immediately apparent because only one 10:1 cycle is shown. This particular RF amplifier is centered close to 5 MHz. As in the previous cases, there are two plots: frequency response and phase. Figure 6 shows the numerical plot. This plot shows that the actual peak in gain (given the number of points plotted) is around 5.078 MHz.

The example shown in Figure 7 is for an open transmission line stub (the program includes a shorted stub example as well, but it is not shown here). Stubs are often used in antenna circuits for impedance matching, phase shifting and other tasks. Like the other circuits, gain and phase are plotted against frequency. In this case, the frequency axis (horizontal) runs from 10 MHz to 300 MHz, and is logarithmic.

The examples given above are from samples provided with the software. You can enter your own network and have the software analyze it.

General Comments

In general, the manuals for these two programs were clear and easy to follow. I would like to see a better index in the rear, as some topics are a bit hard to find. However, I experienced no real problems in installing, setting up or using the software. Contact Number One Systems, Ltd. at one of the addresses given above for further information about Z-Match for Windows, Analyser III and Easy-PC.

"In general, the manuals for these two programs were clear and easy to follow."

Number 17 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
PO Box 2508
Fullerton CA 92633

Guerrilla-Style T-Hunting

"Get set for an exciting adventure when you set out on a T-hunt." I've made that promise to many ham clubs in talks about QRM-tracking and friendly radio direction finding (RDF) competitions. I also tell prospective hunters that they will get plenty of stares as they drive along with unusual RDF antennas on their cars.

But T-hunting (or foxhunting, as it is sometimes called) is 10 dB more adventurous when you're doing it in a land where persons with radio gear are automatically suspected of subversion. Such was the fate of Mark Oppenheim KD6KO. This adventuresome ham has made a dozen trips to third-world countries as a staff member of Volunteers in Technical Assistance (VITA).

For 35 years, VITA, a non-profit aid organization, has applied modern technology to meet the needs of emerging nations. Regular VITA broadcasts on the Voice of America result in a steady stream of incoming requests for information and assistance on technical subjects ranging from candlemaking to oil drilling to digital communications.

VITA staff and volunteers attempt to match inexpensive technologies to these problems. Computers and packet radio equipment are cheap when compared to commercial digital communications methods, so they are often selected for such applications (on non-ham frequencies, of course). KD6KO first heard about VITA in 1989 from a packet message, requesting volunteers to go to The Sudan to set up solar-powered HF packet stations for village communications.

Low-orbit store-and-forward packet micro-satellites such as UOSAT-14 are perfect for inexpensive, reliable intercountry messaging, so VITA has seized the opportunity to use them. In September 1991, a team led by Eric Rosenberg WD3Q set up the agency's first ground station in Sierra Leone. Eric approached the National Telecommunications Company (NTC), the country's equivalent of the FCC, for permission to communicate with UOSAT-14 on 429 MHz, which is just below the 70 cm ham band in that part of the world. NTC's frequency coordinator is Cassandra Davies 9L1YL (Photo A), who said there would be no problem. Only VHF was used there, so there was no need for coordination on UHF frequencies.

Unfortunately, when 9L1/WD3Q switched on the ground terminal receiver, he discovered that the QRP satellite signals were being obliterated by a strong carrier. With the meager test equipment he had with him, he couldn't tell if the cause was a computer in the next room or a strong transmitter miles away. He returned to the USA and KD6KQ was dispatched to solve the problem.

Wild and Woolly

Sierra Leone (meaning "Lion Mountains") is on the west coast of Africa, between Guinea and Liberia. Freetown, the capital city, has a magnificent harbor, the third largest in the world. English is the official language of this nation of 4.5 million people. It is one of the wettest countries on earth, averaging over 140 inches of rain per year.

You will count your blessings as you hear KD6KQ describe daily life in Freetown. Fuel shortages are chronic, sometimes leading to fights at gas stations. Most electronic equipment is powered by batteries because families lucky enough to have electrical wiring to their homes receive power only an hour or two a week, on average.

"People steal the power wiring and sell the copper for salvage," says Mark. "They had a problem with the power station generator, which was built over 50 years ago. The workers had to take off the belt housing to get at the windings. They sent off to the UK for parts and while they were waiting, the belt housing was stolen. Similarly, you quickly learn that the telephones of developing countries are just a novelty. The Sierra Leone phone system is very erratic. Sometimes the international lines go out for days."

Despite all this, KD6KQ says there is an active ham radio community there, particularly among immigrants from Lebanon. Old tube-type HF rigs are common. Hams there form small clubs to pool their meager station resources. Forty meters is the most popular band.

Not knowing what to expect, but wanting to travel light, Mark took a UHF beam, a Wavetek RF attenuator, and an IFR UHF service monitor with built-in spectrum analyzer. "I wasn't sure what we were dealing with and I thought it might be nice to be able to observe the modulation," he said. Upon arrival, he carefully aimed the ground station antenna for maximum interfering signal level in the receiver. Then he went to the roof and looked down the antenna boom. The antenna pointed toward the airport.

Freetown and its harbors are on a peninsula. The airport is on the mainland, a three- to five-hour drive away, depending on the weather. The ferry system is not an attractive alternative. "Ferry schedules are timed to the infrequent airline arrivals and departures," Mark said. "You can get stuck over there for five or six hours. I was thinking, 'I hope I don't have to go to the airport, because I'll have to book the ferry in advance, then be stuck on a boat with goats and other strange animals.'"

With the service monitor, RF attenuator, and a portable yagi, KD6KQ and a helper set out to track the signal. Sure enough, they soon arrived at the beach with the antenna still pointing across the bay toward the airport (Photo B). Instead of immediately calling the ferry company,

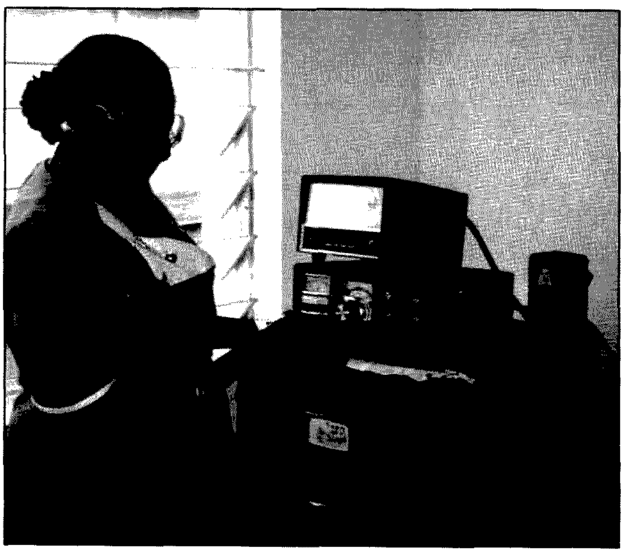


Photo A. Cassandra Davies 9L1YL was president of the Sierra Leone Amateur Radio Club when KD6KQ went on his QRM hunt. She has her station at the NTC office because electrical power is more reliable there.

Photo B. Using a spectrum analyzer, attenuator and yagi, KD6KQ and helper Desmond Cole ended up at the beach, with the signal still appearing to come from the airport across the bay.

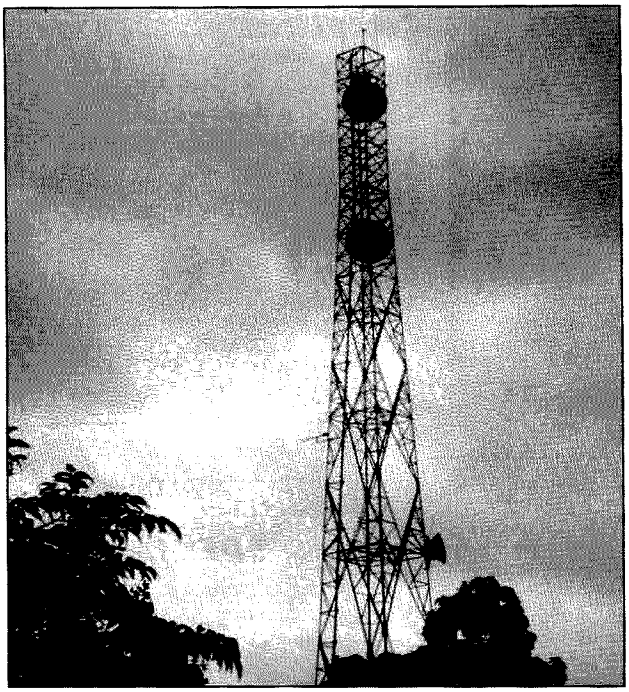


Photo C. The offending signals were being transmitted from the airport to this small yagi, halfway up the tower in downtown Freetown.

Photo D. Thomas Karima, a NTC telecommunications engineer, changed the frequency of the airport telephone link with help from VITA.

KD6KQ decided to do some signal analysis first.

"With the service monitor, I took a look at the spectrum," he went on. "I saw all sorts of interesting sidebands and other activity that was not symmetrical at all. I tuned in some of the sidebands and I was able to hear things like dial tone, busy signal, and people talking. Aha, it must be a telephone link! It's probably communicating with something on this side of the bay. I tuned around the band and down at around 412 MHz I saw a similar emitter. I peaked that up on the beam, and it pointed to a huge tower in the town center."

Just Like 007

Thinking he might avoid a trip to the airport, KD6KQ decided to check out the source of the 412 MHz return signal. Was it really coming from the big tower? This meant RDFing in downtown Freetown, which was sure to arouse suspicion.

"We ended up taking a terrorist approach to DFing," Mark continued. "In most of these countries, if they catch you with anything more advanced than an AM radio, there's always a chance they'll think you're some sort of spy and you'll go directly to jail. So we would park the car, look around, jump out, put the antenna out on a stick, spin it to take a bearing, and throw the stuff back in the car real quick. The whole process took less than 30 seconds each time.

"We didn't have a map, but the tower was easy to see around the town. Sure enough, our RDF antenna always pointed to a little yagi on the side of the big structure. The yagi was aimed toward the airport (Photo C)."

Back at the NTC building, KD6KQ discovered that the man in charge of the local phone system, who worked only two doors down the hall from 9L1YL, had never bothered to notify her of the installation of this UHF phone link. According to Mark, "The airport transmitter was emitting a 2-MHz-wide analog T-1 signal, with sidebands every 350 kHz, at just above 430.0 MHz, inside the amateur band."

Pointing out that sidebands of the system were interfering with both the UOSAT-14 system and the 430 MHz ham band, he pressed them to QSY the link, offering his technical services. There was a delay while everyone waited for an important official to return from the countryside and make the final decision. Meanwhile, Mark went into the helping-ham mode. "9L1YL had a slightly ill Swan transceiver that I volunteered to repair for her," he said. "It's amazing how fast things fell into place once that radio got fixed. It only took us about three days to go out and QSY the link.

"I made a couple of trips to the mainland to swap cards and reconfigure the system (Photo D). Airports are usually pretty strict about their communications, so I figured that they would only let us yank the link down in the dead of night. As it worked out, we went out there to swap some modules and they took it down right at lunchtime. The only problem we had was that the audio baseband board decided to fail at the same time, but we fixed that easily."

A heart-pounding T-hunt is not an everyday activity for VITA volunteers, but they have plenty of interesting challenges. "I'll do anything in a developing country," says KD6KQ. "It's a lot of fun, despite the drawbacks. VITA is looking for people who don't mind going to little-known African countries and places that are unsettled, like Pakistan, to install radio communications equipment. You need both technical know-how and sensitivity to local concerns and customs."

If the idea of electronic adventures in remote corners of the world appeals to you, call VITA headquarters in Arlington, Virginia, at (703) 276-1800 to get a VITA volunteer package. According to KD6KQ, "The best person to talk to is Eric Rosenberg WD3Q. VITA will send you a long questionnaire. You check off your areas of expertise and then your file goes into the computer for matching with upcoming assignments."

In Other News . . .

Judging by my mail, unlicensed operation in our stateside VHF bands is on the increase, often by young people using hand-helds. For instance, Paul Plasters WA3FFL of the Rockford (Illinois) Amateur Radio Association wrote to tell how he and three others (N9OTC, N9VGE, and WB9VLK) tracked down a would-be broadcaster who delighted in making philosophical pronouncements to no one in particular on a local repeater. This pirate used a number of different names and callsigns.

Paul wrote, "Our local foxhunts have given us a lot of experience in RDF. Our group uses several different types of gear, as no one type is right for all occasions. Unfortunately, the search was hampered by indignant licensed hams who put carriers and tones on top of the bootlegger, increasing the difficulty of the hunt."

Upon locating the house from which the signals were emanating, two of the hunters went to the door and asked the mother if she had a son whose hobby was radio communications. "Upon receiving an affirmative answer, we asked if we could come in and converse with her and her husband," Paul continued. "They said they had no idea that what their son was doing was illegal. The father had purchased the handie-talkie from a ham radio dealer in another state."

Several HTs had been stolen in the area lately, so just to be sure, they checked the serial number of the radio. Then they explained to the parents the possible repercussions of continued bootlegging and told them about the club's meetings and license classes.

Let's hear how your club has dealt with unlicensed repeater users. What methods do you use to get repeater users to discreetly cooperate during the hunt? Once caught, should bootleggers be welcomed at meetings and encouraged to take license classes? Have "reformed" bootleggers gone on to become good hams in your area? Write to me at my California address or send e-mail to Joe-Moell@cup.portal.com (Internet) or 75236,2165 (CompuServe). My packet address is KØOV@WB6YMH.#SOCA.CA.USA.NOAM. 73

HAMS WITH CLASS

Number 18 on your Feedback card

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Driving The Point Home

After 14 years of being actively involved with training youngsters in ham radio classes and with recruiting people of all ages, I've come to view everyone as a potential ham. Therefore, I really shouldn't have been surprised about what happened with one of our school bus drivers. The local Staten Island newspapers loved this story and gave it lots of coverage.

Ed Pedersen, is a 59-year-old driver for the Pioneer School Bus Company at Intermediate School 72, now has a new perspective on school and a new relationship with his young passengers. Ed is attending a class with them.

Ed is the bus driver at the slot where I have bus duty every afternoon at dismissal time. We began chatting one day, and Ed asked me what subject I taught. (A fatal question to ask me!) When I told him I teach amateur radio to sixth-, seventh-, and eighth-graders, he became very excited. He told me that he always hears the kids on the bus talking about the fun things they do in that class and he was curious about it.

I gave him an overview of what I do with the youngsters in the radio classes and I invited him to attend a session of the CQ All Schools net. He came in one Tuesday afternoon and listened to the children speaking to other radio operators in California and Texas. The students totally accepted his presence and explained all the goings-on to him. Ed said he loved it, and asked if he could attend the sessions when I do the net on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz. Of course, we gave him a standing invitation.

Ed is a retired manager for AT&T, and has some background in communications. He said he really got interested in amateur radio when he bought a boat with a marine radio. "I just find it fascinating; it's a small world; you know," said Pedersen, who was thrilled when he spoke with a teacher from the Navajo Indian Reservation in Sun Valley, Arizona, during a recent class. Ed told me that he had just finished reading *Bury My Heart at Wounded Knee* and that he got new insight into the Indians and what they went through. He spoke with our net contact, Gary Ragsdale KB7PXI, at the reservation and thoroughly enjoyed the radio contact. He was really overwhelmed when his first QSL card arrived from Gary.

Imagine what a kick it is for me to see Ed's collection of QSL cards (he now has half a dozen) hanging up above the side window of the bus. Every time I come out to bus duty, Ed can't wait to tell me what he's been studying and how much he's enjoying

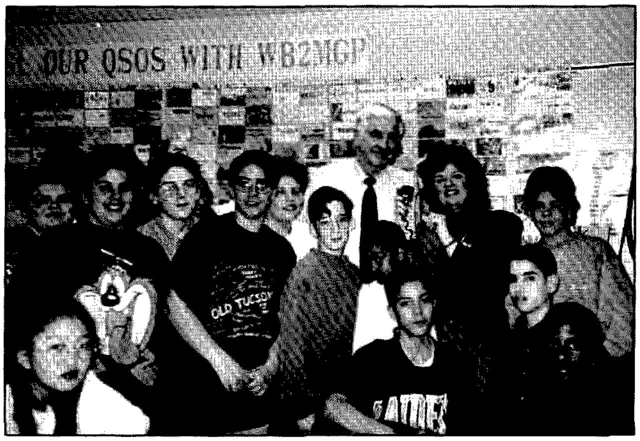


Photo A. The kids love having Ed join us on the CQ All Schools net on Tuesdays and Thursdays.

sharing his experiences with his young passengers.

Pedersen jokes that he's "too old to be a student." He admits that he's taking notes during the program and buying books to help him prepare for the FCC Novice exam. He showed me the stack of code tapes and license manuals he keeps under his seat on the bus. Whenever he gets a few minutes, he studies. He told me that he has given away all the other reading material he used to keep on the bus for the times when he'd be parked and waiting for the kids to come out of school.

The children and I are delighted to have Ed as a regular member of our class when we do the net. From Ed's point of view it has given him a rare opportunity to see what is going on inside the school building. "It's a very rewarding program. It's an eye-opener for me because as bus drivers we don't realize what is being done inside the schools. You can easily see how interested the students are in this program. You don't see that in too many classes" said Pedersen.

It's really funny to see the kids running to Ed's bus to see what new QSL cards he's got hanging up. The cards are the common ground he shares with his afternoon passengers who, he said, board the bus and talk about ham radio class with him.

The moral of the story is to always be ready to enthusiastically talk about ham radio to anyone who will listen. You never know whose life you'll be instrumental in changing forever.

For FREE information about advertisements in this issue of *73*, please use the reader service card located near page 73.

QRP

Number 19 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Wire down the furniture and warn the neighbors! The second printing of the *HW-8 Handbook* is finished. Ever since the first run sold out in the late part of '91, I've been telling everyone I'm going to reprint the handbook. Well, after miles of walking up and down I-77, I finally picked up enough aluminum cans to finance the second print run.

What's Inside?

The *HW-8 Handbook* is filled with modifications for the HW-8 and the HW-9. There are only a handful of modifications for the HW-7. In fact, if you're looking for a modification to improve the receiver in the HW-7, it won't be in the *HW-8 Handbook*. Nearly all the modifications cover the HW-8 and the HW-9.

Since this is only a reprint, no new modifications have been included. So, if you have the first *HW-8 Handbook*, there is no need to get this one.

The price for the *HW-8 Handbook* is $11, including first class shipping to all of North America. All others add $4 for air mail shipping. You can get your own copy by dropping me a check with your name and address. I would not wait too long, only a limited amount of copies have been printed. They won't last very long. Perhaps down the road I'll get enough new modifications for a new version. So, if you have a modification for the HW-7, HW-8, or the HW-9, send them my way.

Everyone knows by now, Heathkit is no longer in the kit business. However, you might be able to get a condensed operating manual and schematic for some of their rigs. Since the schematics are copyrighted by the Heath company, I was unable to reprint the schematics for these three QRP rigs. I sent several letters to Heath asking for permission, but never got a word back. Oh well!

Pacific Crest Bicycle Trail

Bil Paul KD6JUI of San Matero, California, sent this in. He's looking for some QRP contacts along the bicycle trail with other QRPers. The bicycle tour from last summer sounds interesting. Here's the note I received from Bil:

"The week-long July trip involved four hams and one non-ham, and covered about 400 miles along mountainous paved and unpaved roads between Mt. Saint Helens, WA, and Crescent Lake, OR. The four hams, Guy Hamblen of Troutdale, OR, Dan Arbogast of Corvallis, OR, John Talstad of Monebello, CA, and organizer Bil Paul of San Mateo, CA, operated CW QRP on 40, 20 and 15 meters and used 2 meter HTs. Solar cells were used to charge batteries during each day's ride. All contacts were stateside, with the exception of one Finland contact on 20 meters using a tree-hung ground plane."

"The upcoming week-long trip will be in July or August of '94 and will begin at Crescent Lake and will include Crater Lake, Ashland, and Siskiyou Pass, OR, and Horse Creek and Callahan, CA. The trip will end near Mt. Shasta. The tour will primarily camp and cook out."

Any experienced bicycle touring folks who are hams are invited to join the free trip. For more information, write to Bil Paul KD6JUI, P. O. Box 5183, San Jose CA 95150.

Bicycling and QRP ham radio seem to be quite a combination. Thanks in part to the low weight of the rigs and the small amount of energy required to operate them, you can throw a QRP rig in the side bags of your bike and not even notice it's there.

A Solarex MSX-10L is an ideal source of solar power for any bicycle QRP attempt. It's small, about the size

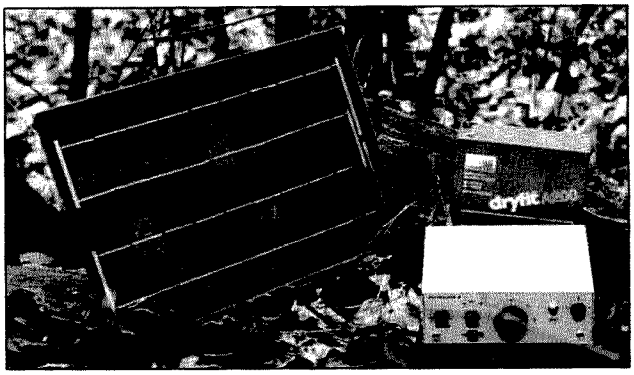


Photo A. Using the Solarex MSX-10L and the Backpacker II in the woods. The sealed gelled battery provides most of the power.

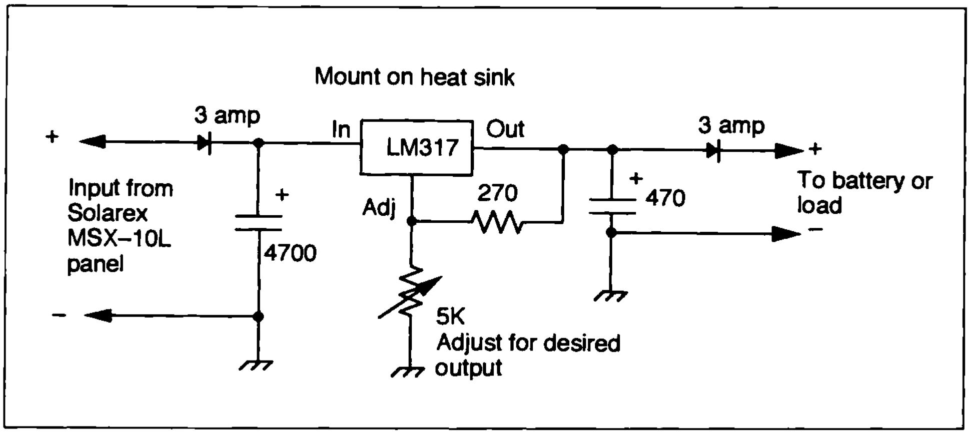


Figure 1. The LM317 in a classic constant voltage regulator.

of a sheet of legal paper, and very lightweight (less than a pound). The MSX-10L is also very hardy. It can take quite a lot of abuse and still generate power. I supplied Bil Paul with his Solarex MSX-10L and he has found it works quite well during a bike trip. There is a hole in each corner so the panel can be held in place with a bungee cord. Of course, the MSX-10L is waterproof! The MSX-10L is $145 from my SunLight Energy Systems company. Send me three stamps and I'll return a short-term catalog.

Batteries are heavy, so you have to have the maximum capacity/weight ratio. In most cases, the common gelled lead-acid battery is the best choice. If your're planning a long trip with an overnight stay in a hotel, then a small AC-powered charger for the battery pack is worth having. You can top off the battery and give it a slight equalization charge, too.

Don't forget about the batteries for the HT, too. If you plan on touring very far, a 2 meter HT is a very good idea. Since most HT batteries are not 12 volts, you have to either have the commercial auto charger plug or a homebrew regulator.

An LM317 adjustable regulator makes this simple to accomplish. You can either set the LM317 as a constant voltage source, or configure it for constant current. The constant current configuration works well with NiCd batteries. In fact, MFJ uses the LM317 as a constant current source in the rechargeable battery pack for their QRP rigs. Figure 1 shows the LM317 in a classic constant voltage regulator. Notice the extra diode on the output of the regulator. This diode prevents the battery from discharging into the regulator at night or when there is not input to the LM317. This circuit does not prevent overcharging of the battery! The diode on the panel side of the LM317 is to prevent damage to the regulator if you connect the panel up backwards to the regulator. A Schottky diode would be the best choice if you have one. If not, then two 1N4001 diodes in parallel will work just about as well. A Schottky diode I've been using in several different circuits is the 3 amp 1N5821.

In either application, you'll need to use a small heat sink on the regulator. The maximum current for the LM317 is 1.5 amps, provided you can keep it cool enough. The MSXP10L will produce 700 mA under full sun.

You can also use this circuit to allow the solar panel to operate a small load directly. If the load is not a battery, you can eliminate the diode and thus gain a little bit more voltage from the LM317. Solar power direct without a battery is a challenge even for a QRPer. Imagine getting DXCC with solar only, no backup!

Adjustment is simple. Connect up the solar panel, or a power supply adjusted to 16 volts, and adjust the trimmer for the voltage required at the output. That's all there is to it. Mount the circuit in a suitable box and you're done. If you plan on using this circuit in the outback, you should seal the entire perf board. I've used hot-melt glue and have had no trouble with it. Or, you might try some liquid casting plastic available from larger hobby stores. Silicon RTV would also work in a pinch.

Next month, I'll have some modifications to several popular QRP transceivers.

ATV

Number 20 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Photo A. (l to r): John Fox, M.D., WB2LLB and Barry Lankford N4MSJ operate from John's ATV studio. The studio offers a variety of special video and lighting effects and has many of the features of a commercial TV installation.

Rocket City ATV

Soon alter moving to the Rocket City (Huntsville, Alabama), I decided to check out the local ATV repeater and see what kind of activity I could find. One of the more active ATVers, Dr. John Fox WB2LLB, invited me over to his station to participate in the weekly ATV net.

As I approached John's house, I noticed that he lived in a geodesic dome (designed by his wife Doris). I had a feeling that I would soon be visiting a very unique hamshack!

ATV Studio

Hamshack is not the word for John's operating area. It really should be called an ATV studio (see Photo A). Looking very much like a commercial TV studio, John's spacious hamshack allows him to produce a variety of visual effects with rows of overhead track lighting that he can independently control. On the right in Photo A you'll see his large 33-inch RCA main viewing monitor (reception of the local K4BFT ATV repeater is shown). Above this he has two smaller monitors: one for previewing his special effects and one displaying his transmitted video.

Two camera positions can be selected: one above the viewing monitor, and one located just to the right of the main desk for close-ups. He can select special effects or switch camera views with his Video Toaster program running on the Amiga 2000. In addition, John has another special effects unit (a Panasonic WJ-MX10 A/V mixer) that also includes a time-base corrector). On the wall behind his chair, there are a series of sliding colored backgrounds that allow John to change the visual effect. One panel is a solid blue color and allows him to perform a variety of chroma-key overlay effects. When sitting at his main operating position, he looks just like he's in a TV newsroom!

John became interested in visual communications after working SSTV. He still is active using his Robot 1200C. He is also quite active on the HF bands as well as the OSCAR satellites. His equipment is nestled neatly inside a customized operating console, allowing him convenient access to just about any band or mode, and to a variety of computers.

The Video Wall

In a wing attached to the main dome, John took me to see his video wall in the room next to his hamshack (see Photos B and C). I was presented with a wall full of multi-standard VCRs, TV sets and monitors neatly stacked on shelves. Shortly after becoming active in ATV and SSTV, John thought it would be great to exchange videos with ATVers in other parts of the world. The problem is that there are a wide variety of video standards. After a lot of searching, he found several multi-standards VCRs that could play back and record in PAL and SECAM. Since assembling his international video wall, he regularly exchanges videotapes with ATVers from Australia (John Ingham VK5KG), New Zealand (Mike Sheffield ZL1ABS), France (Gerard Letrou) and a variety of others around the world. John considers his pair of Panasonic AG-W1-P multi-standard VCRs to be the most versatile since they also transcode from one standard to another. He can easily play back an NTSC tape on one machine and record in PAL or SECAM on the other (converting from PAL or SECAM to NTSC is also possible). John has two other multi-standard VCRs without the transcoding capability (National NV-G500EM and a

Photo B. The video viewing room features an 8-foot projection TV screen and a three-gun Chromalux video projector. The videotape scene shows a newscast describing John WB2LLB and Barry N4MSJ (l to r) operating during Hurricane Andrew.

Photo C. John's video wall contains a variety of multi-standard VCRs and TV sets that can view and record in PAL, SECAM and NTSC.

Philips VR6843/56). He also has three multi-standard TV sets and monitors (SONY PVM-1270Q, Grundig P37-342/90 and a SONY KV-2032ME). A couple of regular NTSC VCRs (both VHS and Beta), video disc players and audio equipment fill up the remaining shelves.

As John started to play a tape from Mike ZL1ABS, he said "Let's watch this on the *big* screen." He pulled down an 80-foot diagonal video projection screen and fired up his Chromalux three-gun RGB projection unit hanging from the ceiling in the back of the room. I was truly in video paradise!

Huntsville ATV Activity

Every Tuesday night at 8 p.m., ATVers in the Huntsville area meet on the K4BFT ATV repeater located 1,000 feet above the city on Montesano Mountain (sponsored by the Tennessee Valley ATV group—TVATV). It has an input on 439.25 MHz and output on 421.25 MHz (horizontal polarization). They usually use the 145.33 (-600) repeater for voice coordination during the activity night. The ATV repeater also offers a touch-tone activated Doppler weather feed which is tied in from the local TV19 weather computer. John and I worked some of the more active ATVers during my visit: W4WAD, WA5KRG, W3PM, KK4HF, N4MSJ, KE4ECM and N4GT, to name a few. If you're in the area on a Tuesday evening, give a look for the repeater; at times as many as 20 ATVers check in.

Number 21 on your Feedback card

ABOVE & BEYOND

VHF And Above Operation

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Surplus Local Oscillator for 2400 MHz OSCAR Satellite, or SSB Operation on 2304 MHz

This month I will continue with the converter aspect of microwave operations and identify a parts bonanza of GaAsFET and bipolar circuitry. Usually, finding GaAsFETs in surplus is rare—that is, other than TVRO devices like LNAs. What I am about to describe is some of the best material from surplus that I have seen, from both the parts and the modification points of view. These surplus PC boards were part of a two-way microwave system for communication and dispatch control of trucks. The business or RF portion that I was interested in is mounted on the roof of a truck cab, looking like a giant white hamburger.

We were fortunate to obtain a quantity of these surplus boards and have made them available for *amateur purposes only.* The PC boards have been removed from their housings to guarantee that the units are broken down from their original configurations. A complete (whole) unit cannot be obtained. Most manufacturers do not want their surplus material resurfacing in the commercial markets to haunt them. Surplus material that is torn apart, reusing some of its components for surplus material, is generally approved for redistribution.

First, a description of the original system. This is a full transceiver for microwave use. The receiver operates on 12 GHz, and the transmitter operates in the 14 GHz range, using a single antenna. A fixed frequency 2.620 GHz synthesizer is connected to a times-5 multiplier, elevating the oscillator to 13.1 GHz, using two GaAsFET stages (MGF-1302). The multiplier board feeds a splitter amplifier board containing a Wilkinson splitter and four stages of amplifiers (MGF-1302 GaAs FETs) at 13.1 GHz. This board supplies local oscillator signal to both the transmitter mixer and receive mixer. The receiver and transmitter have independent IF boards operating at about 1200 MHz. A common power supply board takes +12 volts input and provides switched +10 volts out with a -5 volt bias supply employing a "power good" function. "Power good" means that no positive voltage will output the supply unless the -5 volt bias supply is alive and active. This is a high-quality protection feature for GaAsFET circuitry. GaAsFETs could be destroyed if only positive voltages, or positive before negative bias, were applied. See Photo A for a look at the system's PC boards.

Almost all PC boards use MGF-1302 Mitsubishi GaAsFETs. The exceptions are the IFs, the local oscillator, and the power supply and transmitter. The FETs in the transmitter are MGF-1423s and K25 and K30 FETs. The receiver/transmitter boards can be converted to 10 GHz operation or stripped for an inexpensive source of GaAsFETs for other projects. Check out any recent *ARRL Handbook* for circuits using these FETs. Kent WA5VJB has detailed several amplifiers in many of the *ARRL Handbooks* very well, using the MGF-1402/1302 devices. The GaAsFETs used in the transmitter board are very expensive high-power devices, with the final stage output of 1 watt into the antenna at 14 GHz. Well, I am getting ahead of myself here. That's better left for a future column. So much for the system in general. Back to the synthesizer board and its conversion.

You may be asking, "What can I use an oscillator for at this frequency range?" Well, it can be modified to cover either OSCAR at 2.4 GHz, or 2.304 GHz for weak signal SSB work. Normally, surplus oscillators covering this frequency range are difficult to locate due to low comercial activity. Photo B shows the basic oscillator PLL synthesizer PC board. Photo C is a close-up of just the oscillator circuitry inside the shield compartment on the same PC board.

The unmodified synthesizer board provides a frequency output of 2.620 GHz at +10 dBm. As I said, material for this frequency has been difficult to obtain. Recent upswings in activity with OSCAR satellite operation at 2400 MHz has started a burst of activity. Historically, weak signal work is carried out at 2304 MHz and satellite OSCAR work operates at 2400 MHz. These frequencies offer several possibilities for local oscillator conversion schemes using a 2 meter IF system. The synthesizer is not limited to the 2 GHz band but can be used on other harmonic-related frequencies as well. It might be possible to re-configure the multiplier to multiply by 4 and use the oscillator and multiplier to form a 10 GHz local oscillator. (A 148 MHz IF, LO frequency of 2555 MHz, times 4 = 10220 MHz. An operating frequency of 10368 MHz-148 MHz (IF) = 10220 MHz.) This aspect of the multiplier splitter board will be addressed in next month's column.

"You may be asking, 'What can I use an oscillator for at this frequency range?' "

Other possible combinations include: 5760 MHz-145 MHz IF = LO of 5615 MHz, or 1/2 that frequency is 2807.5 MHz. (I hesitate to mention that possibility as I have not tried this upper frequency combination out. I only mention it as an experimental choice to try. It's certainly OK as far as the math goes.) Will the DR (dielectric resonator) go up in frequency? I am not sure. In any case, it's a numbers game with the IF frequency and step size (2.5 MHz) as variables.

Let's take a look at the basic synthesizer unit. It uses a Motorola MC-145152 PLL (Phase-Locked Loop) chip and phase locks the oscillator at 2.620 GHz with +10 dBm of power output. The PC board is no bigger than a pack of cigarettes. For operation it requires a +10 VDC input and a 10 MHz reference oscillator as its system clock. Supply those two signals and the PC board functions. The 10 MHz needs to be of high accuracy for an accurate microwave frequency output.

The oscillator is a microwave dielectric resonant oscillator (DR or DRO if you prefer), with two stages of

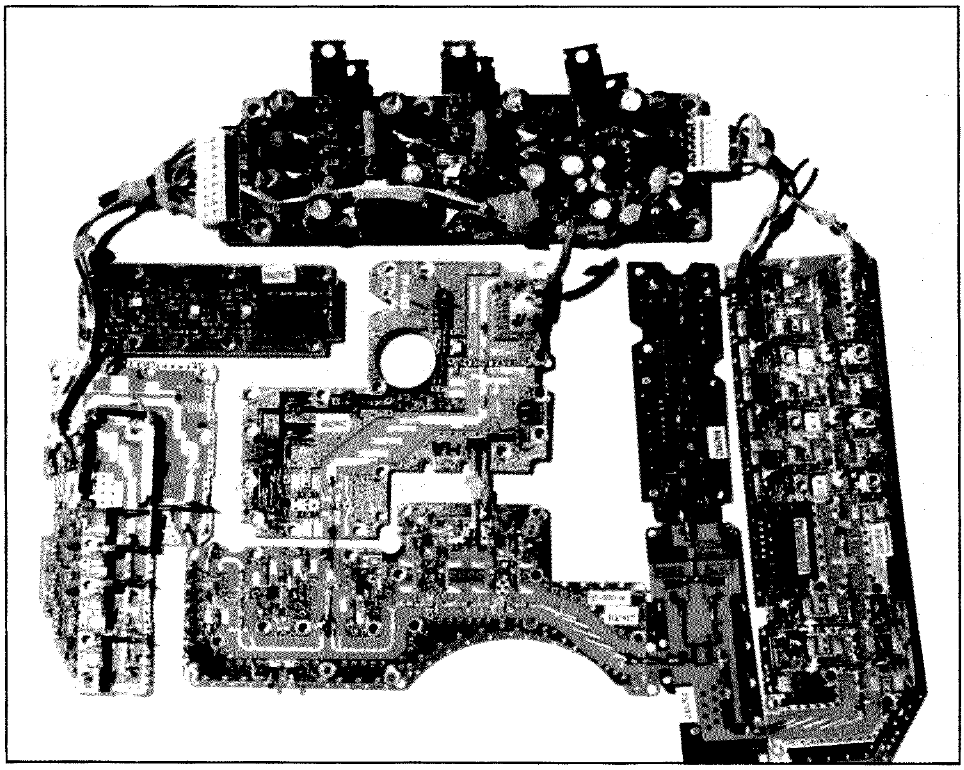


Photo A. Microwave TX-RCV PC boards showing the interconnections between the boards (see text).

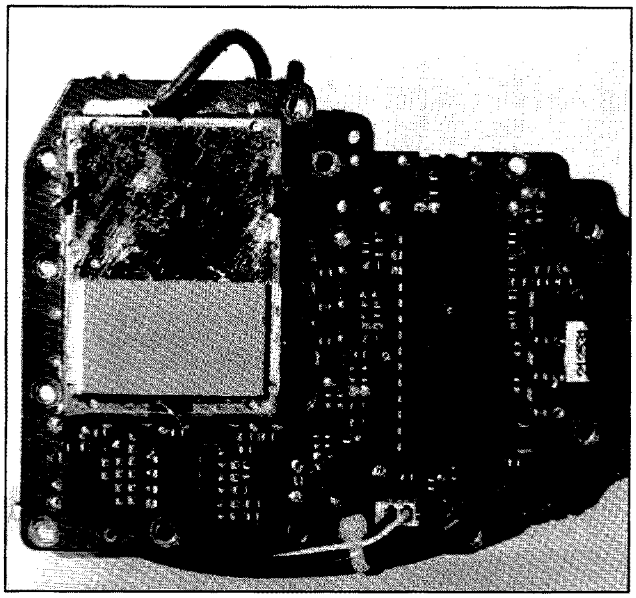


Photo B. 2.620 GHz synthesizer/oscillator. Note the large chip Motorola MC145152 PLL. The metal box contains the DR, oscillator, 2-stage amplifier, and modulus divide by counter chip—a MB510.

1. F IN	2. VSS	3. VDD	4. RA0	5. RA1
6. RA2	7. 0R	8. 0V	9. MOD CTL	10.A5
11. N0	12. N1	13. N2	14. N3	15. N4
16. N5	17. N6	18. N7	19. N8	20. N9
21. A1	22. A2	23. A0	24. A3	25. A4
26. OSC OUT	27. OSC IN	28. LOCK DET		

Note: Pull up resistors internal to chip counter programming pins.

Table 1. Pinouts for the MC-145152 synthesizer chip.

amplification. The synthesizer is unique in that it uses a technique called "Dual Modulus Counting" in both the main synthesizer chip, a Motorola MC-145152, and the divide-by pre-scaler chip, an MB-510, that is an 8-pin chip mounted inside the oscillator shield cover. The MB-510 has a control lead attached to the Motorola PLL chip to control one of two counting (divide) rates. When the "N" counter is active the control line is low, and the chip divides by 256. When the "A" counter is active the control line goes high and changes the division rate to 16. It sounds tricky and it is. However, it is all taken care of on the PC board.

The Motorola MC-145152 chip has three counters that are pin-programmable. They are the reference counter, called the "RA0" counter, and the programmable counters, (Dual Modulus) "N" and "A" counters. All three are internal on the MC-145152 synthesizer chip. Table 1 shows the pinouts for the MC-145152 chip.

Let's examine how to use Tables 1, 2 and 3, as they apply to a stock unmodified oscillator whose frequency is 2.620 GHz. In this case the stock "RA0" counter is set to 8, and all RA0 pins are grounded. The "A" counter is set to 3. The "N" counter is set to 8. The formula looks like this: (1.25 MHz is the existing reference frequency). 2620 MHz = 1.25 MHz X (N X 256) + (A X 16) or, 2620 MHz = 1.25 MHz X {(8 X 256) + (3 X 16)}. The total division number is the frequency divided by the reference frequency, or 2620 MHz / 1.25 MHz = 2096. Pinwise on the MC-145152, its A0 and A1 are open; A2, 3, 4, and 5 are grounded. That equates to pins 21 and 23 being open and pins 22, 24, 25, and pin 10 being grounded, giving the "A" counter a value of "3."

The "N" counter is set to "8." Pinwise on the MC-145152, its N3 is open, and N0, 1, 2, 4, 5, 6, 7, 8, and 9 are all grounded. That equates to pin 14 being open, and pins 11 through 13 and 15 through 20 being all grounded. At all times the "N" counter must be greater that the "A" counter for proper operation.

The "RA0" counter is set to "8" and all three RA inputs are grounded: RA0, 1, 2, or pins 4, 5, and 6 of the MC-145152.

Initial Checkout

Connect 10 volts to the power red wire and a 10 MHz frequency reference oscillator to the black coax cable on the PC board. Microwave output at 2.62 GHz, with a power level of about +10 dBm, should be observed. Make this test to the gray coax cable that is attached to the shield compartment on the board.

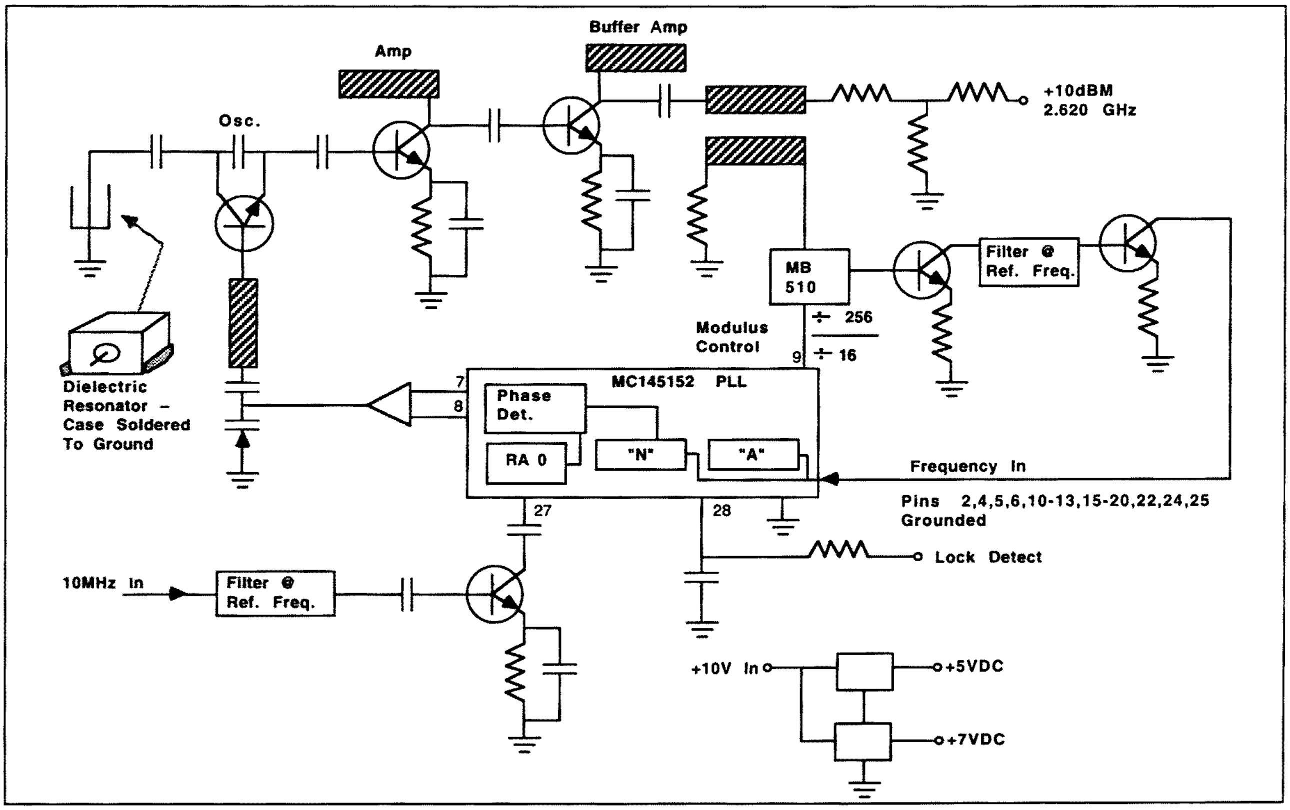


Figure 1. 2.620 GHz PLL synthesizer PC board block.

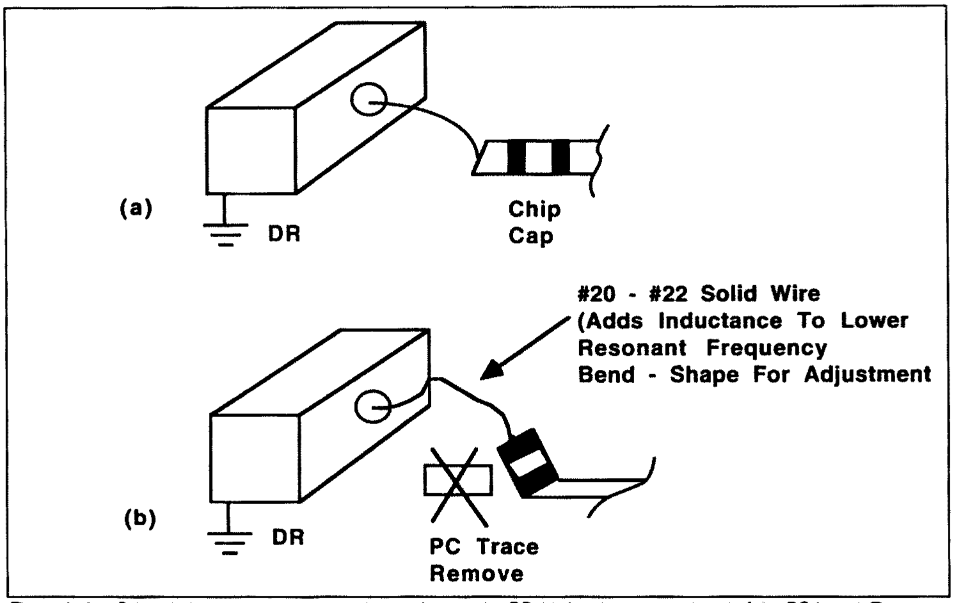


Figure 2 (a.) Original circuit chip cap mounted very close to the DR (dielectric resonator) end of the PC board. Trace connected to the center of the DR. (b.) Modified circuit to resonate at a different frequency. Remove and save chip cap. Remove PC trace near the DR. Re-solder the chip cap and stand on end. Attach a short length of #22 solid wire to the DR to re-resonate the circuit.

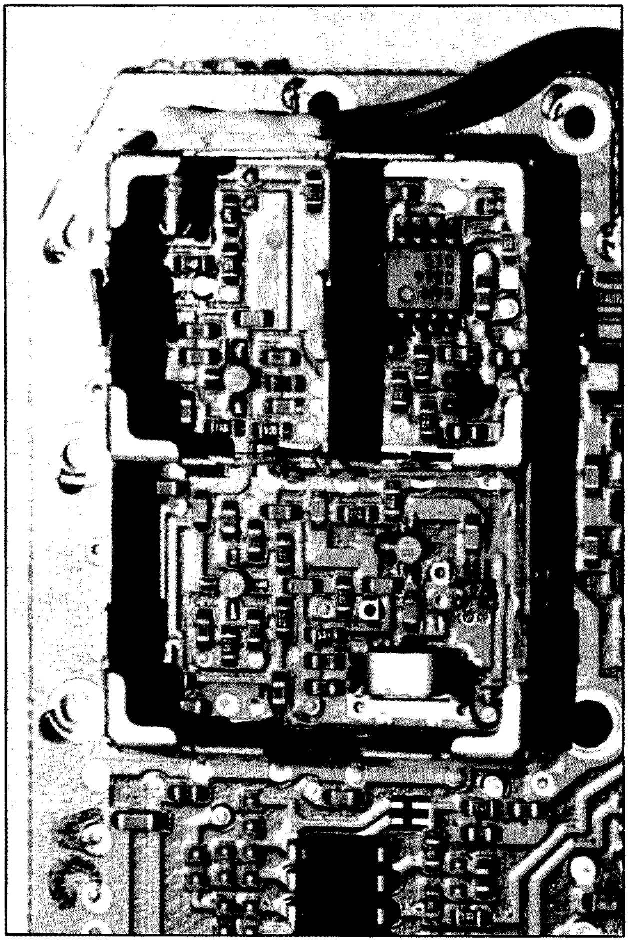


Photo C. Close-up shot of the oscillator and DR (silver rectangle), three transistors, modulus counter (8 pin DIP), inside metal shield compartment. Large 8 pin IC is an OP-27 P/O PLL varactor control circuit.

Modification to Other Frequencies

Modifying these stock synthesizer oscillators to new frequencies makes them very desirable for a variety of different applications. One reprogramming attempt did not function as planned at first, due to gremlins. The frequency desired was 2160 MHz, and the trouble was that the oscillator would not phase-lock, i.e.: *big-time gremlins.* The LO frequency was to be used with a 144 MHz IF for 2304 MHz. Math-wise, the formulation should have worked. Example: Assume LO = 2160 MHz / 1.25 MHz reference frequency equals 1728, division ratio. (1.25 MHz reference when the RA0 counter is set to 8, using the stock board.) The formula is: frequency / reference = (N X 256) + (A X 16), or 1728 = (6 X 256) + (12 X 16).

The math is OK but the Motorola synthesizer chip will not work. According to a note in other *dual modulus counter-applications* data sheets, you should *"never have the 'N' counter-programmed to less than the 'A' counter."* Well, the above formula violates this rule and does not work. Another way to solve this problem is to modify the reference divide-by from 1.25 MHz (8 in the RA0 counter) to divide by (64 in the RA0 Counter). Example: 10 MHz / 64 now = 156.25 kHz, new reference frequency. Then, 2160 MHz / 156.25 kHz = 13824 division ratio, which yields "N" counters higher than the "A" counters for a frequency of 2.160 GHz. Using this scheme, the synthesizer would lock up.

Phase Noise Modification at 156.25 kHz

To clean up the phase noise of the oscillator, the loop filter is set to have maximum loss at the reference frequency. Normally it is set (stock) to 1.25 MHz. When we modify the RA0 counter to divide by 64 we must also modify the loop filter circuit to the op amp *lower* in frequency. The circuitry will function without this loop filter being re-adjusted, but the phase noise will be high. To bring phase noise back lower we need to increase the capacitors in the loop filter by a factor of 8. This change of 8 reflects the same ratio change in frequency (1/8) as the previous frequency (1.25 MHz).

The filter is located on the input of pins 5 and 6 of the op-27 operational amplifier. It is an RC filter and is composed of several 1k resistors and the shunt capacitors; two each 0.001 μF at the bottom of the PC board. There are two 0.01 μF caps in series with two 13k resistors. This is the loop filter that must be modified to supress the phase-noise products.

The Dielectric Resonator

The dielectric resonator (DR), a rectangular silver-plated ceramic-type object located in the oscillator shield compartment must be trimmed to the new desired frequency. It is resonant at 2620 MHz and needs to be slightly modified in order to be resonant at other frequencies. Several different methods can be used to modify this dielectric material, changing its resonance to a new lower frequency. (Without this change the phase-locked loop will not lock up.) If the frequency change is not great, a gimmick capacitor from ground, brought near the center element of the DR, will do the trick. You can test this by placing your finger near the circuit for the same effect. It has been suggested that the DR can be adjusted by applying a measured amount of silicone RTV goop to the DR to accom-

"A" Counter		"N" Counter	
A0 = 1		N0 = 1	
A1 = 2	may be set	N1 = 2	may be set
A2 = 4	from	N2 = 4	from 3 to 1023
A3 = 8	0 TO 63	N3 = 8	
A4 = 16		N4 = 16	
A5 = 32		N5 = 32	
		N6 = 64	
		N7 = 128	
		N8 = 256	
		N9 = 512	

Table 2. "A" and "N" counter-programming values.

RA2	RA1	RA0	÷ by ratio
0	0	0	8
0	0	1	64
0	1	0	128
1	0	0	256
1	0	1	512
1	1	0	1024
1	1	1	2048

Note: 0 = ground; 1 = open (+5V internal pull-up resistor)

Table 3. "RA0" counter reference divide-by ratio.

plish the same trick. I have not yet tried this approach.

If the resonator needs to move by a great span of frequency, such as 2160 MHz, a different approach is needed. In this case, cut the circuit connection from the center element of the DR to the chip capacitor right below the center element of the DR. Bridge this gap with a short section of #20 solid wire bent into a hairpin loop. Solder the hairpin loop from the center of the DR to the chip capacitor. Use a piece of #20 wire about 3/16" long and formed into a hairpin. This inductor is quite critical and requires some fiddling to properly re-resonate the dielectric material to the new frequency.

Another similar method is to cut the trace as above and remove the chip cap and save it. Remove the trace near the resonator that previously connected the DR to one end of the chip cap. Then reattach the chip cap to the remaining far end trace and stand the chip cap on end and solder. Connect the #20 bare wire from the vertical chip cap and reattach it to the DR center element. Adjust the form of the wire to provide enough inductance to re-resonate the DR to your desired frequency. Pete Bauer W6DXJ worked out the above details. It has worked well from 2000 MHz to about 2800 MHz, enabling the PLL to lock up much easier, according to Pete.

Some means will have to be made to compensate for the metal cover plate which will change the adjustment when it is put back into place. All is not lost, but some fiddling will be required to re-compensate the DR and hairpin loop when the cover is replaced on the oscillator compartment.

Well, that's it for this month. Hope you can make use of this oscillator and the newer technology that is starting to show up in surplus. This example is but one of many different types of oscillators that are available today.

Mailbox

Mike K8MB wants to know if it is possible to describe some methods of obtaining the resonant frequency of a stripline compartment such as the K2RIW amplifier before applying power. Mike states that he has been fascinated by these stripline amplifiers for a long time and would like to design one, but he doesn't have the formal training. Mike also has built an amplifier using an 8938 final, and both amplifiers described here are for 432 MHz. Well, one source would be Dick K2RIW, who designed the first amplifier you mentioned. I will give Dick a call and fill you in on the results.

Concerning power amplifiers, I am a poor source for recomendations as I can't coexist in the same room with their blower motors as my hearing is poor. I lost all my high-frequency response due to U.S. Army demolitions work quite some time ago. My hearing range is excellent in the low-frequency range where knuckle-dragging behemoths and blower motors or motorized fans make their noise. Any amplifiers that I build have to be conduction-cooled, and silent! Hence, most of my amplifiers are solid-state or conduction-cooled tubes for silent running in the shack. Concerning technical books, there are several. Almost any edition of the the *ARRL Handbook* does a good job on high power amplifiers. There is another book that was available some time ago from Eimac, the power tube manufacturer, called *The Care and Feeding of Power Amplifier Tubes*. This book might still be available. Check with the Eimac division of Varian, Industrial Tube Division, 301 Industrial Way, San Carlos CA 94070; (415) 592-1221. I don't know current pricing on the Eimac book.

Next month I plan to cover circuitry in the multiplier amplifier, splitter distrubition amps. All the results are not in yet, but it seems promising.

Here is a list of pricing and board availability for those interested: synthesizer PC board $15; oscillator multiplier and amplifier splitter boards $20; 12 GHz rec. $12; 14 GHz 1 watt xmtr $25; power supply $15; or a full set of the above listed PC boards for $75. All prices plus shipping 1st class US Mail $3, 2 lbs., Priority Mail. Requests to Chuck Houghton WB6IGP, 6345 Badger Lake Ave., San Diego CA 92119.

As always, I will be glad to answer questions concerning this and other related subjects. Please send an SASE for a prompt reply. 73 Chuck WB6IGP.

Example	Other Possible Solutions	Lo Inj	Op Freq	IF Freq
N = 54,	A = 0 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 53,	A = 16 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 52,	A = 32 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 51,	A = 48 for a LO of 2160 MHz	Loside	2304 MHz	144 MHz
N = 61,	A = 4 for a LO of 2450 MHz	Hiside	2304 MHz	146 MHz
N = 63,	A = 10 for a LO of 2550 MHz	Hiside	2400	MHz 145 MHz

Note: All above examples RA0 counter modified from the original circuit by removing ground (pin 4 of the MC-145152). Reference frequency is now 156.25 kHz. (To find the division ratio, divide the desired frequency by 156.25 kHz. Example: 2160 MHz/156.25 = 13824. Lower divide by referance frequency gives synthesizer step frequency at 2 GHz of a 2.5 MHz step. With 1.25 MHz reference frequency on a stock board, step size is 20 MHz.

Table 4. Other synthesizer programming ratios. Frequencies selected for weak signal frequencies and OSCAR work on 2 GHz.

Number 22 on your Feedback card

ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

QRH

When we think of interference, the first thing that usually comes to mind is the possibility of our causing it to others. In today's RF-sensitive world, it's become all too easy to make a mess on a neighbor's VCR, TV, portable phone, you name it. But there's another kind of interference, and that's interference to *us!* Let's face it, ham signals usually aren't nearly as strong as those from commercial broadcast stations, and we need all the RF peace and quiet we can get. On VHF/UHF FM, the problem usually is minimal, because of the noise-rejecting nature of FM. But on HF, and even on VHF SSB, it's another story. There's QRM (man-made interference) and QRN (natural interference) aplenty. So, in the interest of learning to recognize the various kinds of noises, let's take a wander through the wonderful world of interference to hams—what I like to call QRH.

Mother Nature Is A . . .

Noisy lady! Atmospheric noise is a result of all kinds of natural processes, but probably most of it comes from static discharge between charged molecules in the air, caused by simple friction. Typically, QRN sounds like random static. If there's a storm front, of course, it gets really bad, especially on 160 and 80/75 meters. It tends to be quietest in the winter, with summer levels rising dramatically. Why is it worse down on those frequencies? Like any electrical process, the discharges have finite rise and fall times. Consequently, they have an upper frequency limit. Theoretically, there is some energy at frequencies going way up beyond UHF. In practice, though, the amount of energy decreases rapidly as you go up in frequency. So, there's a natural rolloff effect. At 3.5 MHz, there can be enough juice to swing your S-meter up to 40 over 9 or more. But, by the time you get to 14 MHz, QRN rarely goes over S-7 or so. And, above 30 MHz, the effects are pretty small. By the time you get to the 2 meter band, static would be pretty tolerable, even if you were to use AM, like they did in the early days of the band.

Mama Nature makes other sounds besides the familiar static crash, and some people find them interesting enough to actually build receivers just to listen to them! In particular, there's a phenomenon called the VLF whistle. Taking place way down there below 100 kHz, the whistle can sound quite eerie. It's caused by some odd discharge effects associated with lightning, so it generally shows up around storm fronts. Once in a great while you can hear one on the AM broadcast band.

On occasion you can hear other sounds as well. I've heard ticks, pops, squeals, and other assorted, hard-to-describe sounds. If you want to listen for them, try tuning an AM pocket radio to the bottom of the dial, away from any stations, if at all possible. Better yet, if you have a general coverage receiver that goes way down there, try that. Just keep in mind that using an outdoor antenna when a storm's around is foolhardy.

> ***"Just keep in mind that using an outdoor antenna when a storm's around is foolhardy."***

Go Away

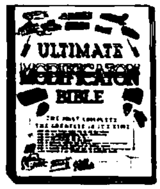
What if you *don't* want to listen to those noises because you'd rather listen to actual stations? There are ways to greatly reduce the effects of QRN, but they take some doing. I've never found noise blankers to be useful against static crashes on 75 meters. The darned crashes just don't have fast enough rise times to trip the blankers, which are really designed to stop fast-rising, man-made impulse noise. The best way to reduce static crashes is via the antenna. Some people use a noise-sensing antenna, which picks up the static but doesn't hear most of the signal. Once you have a sample of the noise without the desired signal, you can invert it and cancel out the noise in the receiving antenna. It works, but it can be tricky to get it to work well. Another approach is to use a loop antenna, because loops tend to ignore a lot of noise anyway. The worst antenna to use in noisy conditions is an unbalanced one, such as a quarter-wave vertical or an end-fed wire. The difference in noise pickup between a vertical and a loop is nothing short of astounding.

Making Our Own Mess

Unless you're operating on the lower HF bands, QRN probably won't be much of a problem for you. Much more likely, your noise troubles will be man-made. QRM can come from so many sources that I couldn't even begin to cover them all. Let's take a look at some of the more common ones.

That Darned TV

Yup, we can indeed be plagued by reverse TVI. TV sets are among the dirtiest electronic animals on earth. The receivers themselves usually are decently shielded, but the picture tube and its associated scanning and high-voltage circuits tend to have no shielding whatsoever! Almost always, the only thing between you and the yoke coils is the plastic cabinet. And, the scanning currents which sweep the beam across the tube in the required raster pattern are, by necessity, sawtoothed waves. That means harmonics. Many sets put out remarkably strong signals all the way up through



at least the 20 meter band. The tip-off that an offending signal is coming from a TV is that it repeats about every 16 kHz. 15,735 Hz, to be exact. That ragged-sounding signal comes from the horizontal scanning frequency employed by American-standard (NTSC) TV systems. (TVs in other countries use different horizontal rates, resulting in their signals' repeating at different intervals on the radio dial.) The vertical scan, which occurs at 60 Hz, also can make some noise, but usually the horizontal is the one you'll hear from next door. That's because the horizontal sweep is also used to generate the high voltage required by the picture tube, with very fast rise-time pulses driving a "flyback" high-voltage transformer. So, you've got fast, high-voltage stuff running around like crazy, and noise is inevitable.

Another source of reverse TVI is the color crystal. Color decoding is accomplished through synchronous demodulation. The standard technique is to sync a crystal oscillator's phase to the "burst" phase reference signal riding on the end of each horizontal sync pulse. The oscillator runs at 3.579545 MHz, which is just above the lower edge of the 80 meter CW band. In fact, some hams who are causing TVI to others deliberately listen to that frequency to see if any nearby TVs are on! If they can't hear anything, it's a good bet there's nobody around to bother. Now and then, harmonics of the color oscillator can be heard, but they're usually weak.

With VCRs in every home, a new source of TVI and QRH has mushroomed. VCRs are very complicated beasts, and they have all kinds of frequencies running around in them. Like TVs, they have color oscillators. They also have FM RF generators in the 3 to 6 MHz range, which are used to actually put the signal on tape. Plus, there are servo systems and multiphase motor drivers. Yuck! Unlike TVs, though, most VCRs have metal cases, at least on three sides. Still, they can be noisy, and they do tend to pick up our signals when we least want them to.

If your neighbors are on cable, chances are you're glad, because you have much less chance of causing TVI. But, some cable systems are leaky. In addition to letting your transmitters' signals in, leaky cables let their signals out to disturb you. They show up as noises and carriers on the 2 meter band, because cable systems use those same frequencies. I've never heard of HF noise being caused by cable, though; they don't use frequencies that low.

A Houseful of Gadgets

These days, darned near everything in the house has a microprocessor in it, and all micros use high-frequency pulses to operate. Here comes my pocket shortwave, looking for the strongest signal.

But wait, there's more. Many of today's devices use switching power supplies. Just about all computers do. So do fax machines. Sometimes, even innocent-looking little AC adapters actually are miniature switchers! In particular, the ones that come with laptop computers and camcorders will be switchers. The one on my fax machine is noisy as heck. Unfortunately, it likes to yowl on the 20 meter band. Why it couldn't have picked some obscure military frequency, I don't know. The signal sounds a lot like a TV set, with a wavering, coarse noise repeating up the dial. Unlike a TV, though, it drifts, and it also doesn't repeat at the TV rate of 16 kHz.

If you think we've covered all the QRH sources, think again! There are fish-tank heaters, neon and fluores-

"These days, darned near everything in the house has a microprocessor in it, and all micros use high-frequency pulses to operate."

the noise! But, before you go complaining to the neighbors about their stuff, take a look at your own. Every digital clock you own is potential trouble. Most use pretty low-frequency crystals, in the 100 kHz range. They can have troublesome harmonics, but most clocks operate with such low power that you won't hear them. Some, though, can be a pain. I've got something in my house that generates a strong signal on 14.318 MHz. I know that's a common microprocessor frequency but I still hear it, even with all the computer gear off. But consider this: Any device which keeps time when off must have a clock and, therefore, an oscillator going all the time! I guess the only way I'll ever find that darned thing is to go around with cent lamps, and even central heating/cooling system thermostats. The fluorescent lamp issue can crop up where you least expect it. Many ham radios use fluorescent displays, and the darned things can sometimes get into your receivers! Also, your own rigs' oscillators can get into other rigs! I used to have that problem with a 2 meter rig that sat on top of my HF radio. The HF radio put out a pretty strong local-oscillator signal which I could hear all over the place on 2 meters. As I'd tune the HF rig, the signal would suddenly break the squelch, giving me quite a surprise.

One common source of QRH which has gotten a lot of press in the last few years is the touch lamp. These things use an oscillator which quenches when you touch the metal base of the lamp, tripping a circuit which turns the light on or off. But, that continuously-running oscillator wanders all over the place, and the cheap lamps put out harmonics which can be heard at a tremendous distance. I'll never know for sure, but I suspect that's what I was subjected to back when I lived in an apartment building in Boston. I had such noise I couldn't hear much of anything on HF a lot of the time. Pocket radio in hand, I scoured the building, but every darned piece of metal in it radiated the noise, with seemingly equal strength! I never did find it, but a neighbor three floors down moved out one day, and the noise disappeared.

One final source of noise which bears mention is the electric company. Bad insulators, leaking or arcing transformers and such can create all kinds of RF monsters. And one of the worst offenders of all is the streetlamp. I've heard more noise from those stupid things than from anything else. If your power-line noise goes away after it rains, chances are it's caused by a bad insulator. If it only comes on at night, suspect the streetlamp, especially if there's one really close by. In theory, they will come out and fix these problems pronto, because they don't want all the other issues that go with them. In practice, though, it seems to vary by region; some electric companies really will run out and make repairs, while others couldn't care less.

Well, I hope you've enjoyed this look at QRH. Sometimes, it seems a wonder we hams can coexist with all the RF-producing and sensitive devices under which we're buried. Remarkably, it usually all works fairly well. But, the number of noise makers is only going to increase, and it pays to be able to recognize the likely sources by their characteristics. All's fair in love, war and radio! Until next time, 73 de KB1UM.

73 INTERNATIONAL

Number 24 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

The spring blahs have arrived! It's between winter and summer here in New England as I write this (April 3), also known as "mud season." I keep looking out my back window hoping to eventually see white snow replaced by the green of grass.

I also look at the tree limbs lying in the yard, still covered by some snow and ice. Several of these limbs caused my 160 meter dipole to return to earth, along with the limbs. Luckily, the wire didn't break (I use a pulley and counterpoise at one end) and I was able to restore it to almost its original position and condition.

Many other hams are making plans to put up new antennas or reconfigure others. One ham is moving into a new house, so I see an antenna party coming on.

Plans are now in the works for a bigger and better Field Day than last year, and the year before, and the year before that, etc. The fever has taken hold. Now starts the fun part of the year, as long as the weather cooperates. I guess we'll come out of the spring blahs pretty soon, after all.

Thanks to Ted Melinosky K1BV for his information from Romania. Ted is the editor of the K1BV Directory of DX Awards. *I am told by many DXers and award chasers that his directory is the bible for DX Awards. Keep up the good work, Ted. You can get more info from him or send info to him at the following address: HCR 10 Box 837A, Spofford, NH 03462-9740, USA.*

Charles Warrington WA1RZW, 73's *Senior/Technical Editor, has written to many of the Caribbean Islands to find out what each island requires for a ham to be able to operate legally. Only two have replied to date: the Commonwealth of Dominica and St. Kitts-Nevis. The responses from both follow in "Roundup."*

We at 73 *would be very happy to publish the requirements necessary for hams from other countries to operate in your country. Please send your information to Charlie or myself at the* 73 *address and the abbreviated info will be presented along with the appropriate address and fees (if provided).*

That's enough from me. On to the ham news from around this great world of ours.—Arnie N1BAC.

Roundup

Caribbean *Letter from Vincent Bacchus KA2CPA:* The Friendly Caribus Connection is a Caribbean/United States regional Amateur Radio Communication Network established in January 1978, influenced by the need for maintaining contacts between Caribbean-rooted hams and their counterparts and families.

Since its inception, the net has operated daily and has contributed to encourage friendliness, warmth, and helpfulness that characterized the West Indian identity.

The formal net operates on 14.283 MHz every morning between the hours of 1030-1200 UTC on weekdays and 1100-1400 UTC on Sundays. On most afternoons they gather at about 2130 UTC for rag-chewing.

Since 1982, a convention is held every two years. The first was held in St. Vincent and The Grenadines J8; the second in Barbados 8P; the third in Trinidad & Tobago 9Y; the fourth in Dominica J7, where a constitution was ratified; the fifth in St. Lucia J6; and the sixth will be held this year in Grenada J3 from August 8th-13th, 1994.

The Friendly Caribus Connection has now embarked on yet another project, the sponsoring of an award certificate for working the 13 1993 member countries of The Caribbean Community and Common Market, called CARICOM.

The award certificate which is hereby submitted for display would be issued to each ham applying and showing evidence of the qualifying requirements. Send the application and a copy of your log (certified and signed by another ham, NO QSLs), with $5 US to cover postage, to: The Friendly Caribus Connection, c/o Vincent Bacchus KA2CPA, 130-72 227 Street, Laurelton, NY 11413.

The rules are basically to contact each of the member countries on any band or mode, or any combination of bands and modes since January 1994. The countries are: Antigua V2, Bahamas C6, Barbados 8P, Belize V3, Dominica J7, Grenada J3, Guyana 8R, Jamaica 6Y, Monserrat VP2M, St. Kitts/Nevis V4, Ll. Lucia J6, St. Vincent & The Grenadines J8, and Trinidad & Tobago 9Y.

Columbia *Letter from Colonel (Ret) Alvaro Martines-Saltedo HK3AVA, President, Liga Colombiana de Radioaficionados:* Due to the importance of Malpelo and San Andres Islands as DX countries, this letter is to provide some information of the facts that we consider important, related to the recent operation of I2RAO, Ermano Ramaioli, from the Columbian islands of Malpelo, Gorgona and San Andres.

1) The permit extended to Mr. Ramaioli by the Colombian Communication Authorities to operate from these islands, although legal, was irregularly issued, since our law requires the existence of a reciprocity agreement, and there is none signed with Italy.

2) Mr. Ramaioli did not request a permit to disembark in Malpelo, currently under the Naval Administration Service. However, due to a miscommunication, he was allowed on the island for two days. This means that on the other days of his operation he was not actually operating from the island.

We consider that these facts should be known by those who made contacts with I2RAO/HKØ. However, by expressing them, we don't want to imply that Mr. Ramaioli has committed any illegalities. This information has already been sent to the ARRL DX Advisory Committee for their consideration. *Colonel (Ret) Alvaro Martines-Salcedo, President, Liga Colombiana de Radioaficionados, A.A. 584 Y 4259, Santafe de Bogota D.C., Colombia. "Radioaficion y servicio para todo el mundo."*

Commonwealth of Dominica *Letter from Olwyn Norris, DARC:* In order for an amateur radio operator, who is licensed In the United States or any other country, to operate In Dominica, he would have to furnish the Ministry of Communications, Works and Housing with evidence that he is in fact a licensed operator. Normally, a copy of his license is presented. Then, a guest license, duly signed by the Minister, is issued. It is a simple process, the length of which depends on the availability of the Minister.

It should be noted that guest licenses are issued to operators in person and never in advance of their arrival in the country. *[Olwyn Norris, Secretary, Dominica Amateur Radio Club, PO Box 613, Roseau, Commonwealth of Dominica.]*

Republic of Crimea, Ukraine *Letter from Andy Morrison KZ1L:* UU2JQ has informed me that since no QSLs have been received from Box 88 since 1992, a new bureau for the Crimea has been set up.

All cards for the Crimea (callsigns beginning with UU) should go to: QSL Bureau of The Crimean Republic, PO Box 38, Simferopol, 333000, Republic of Crimea, Ukraine.

Rusty adds, "Don't send $, please send only IRCs." *[Andrew Morrison KZ1L, 2 Joan St., Pepperell, MA 01463-1322.]*

Romania *Letter from Ted Meli-*

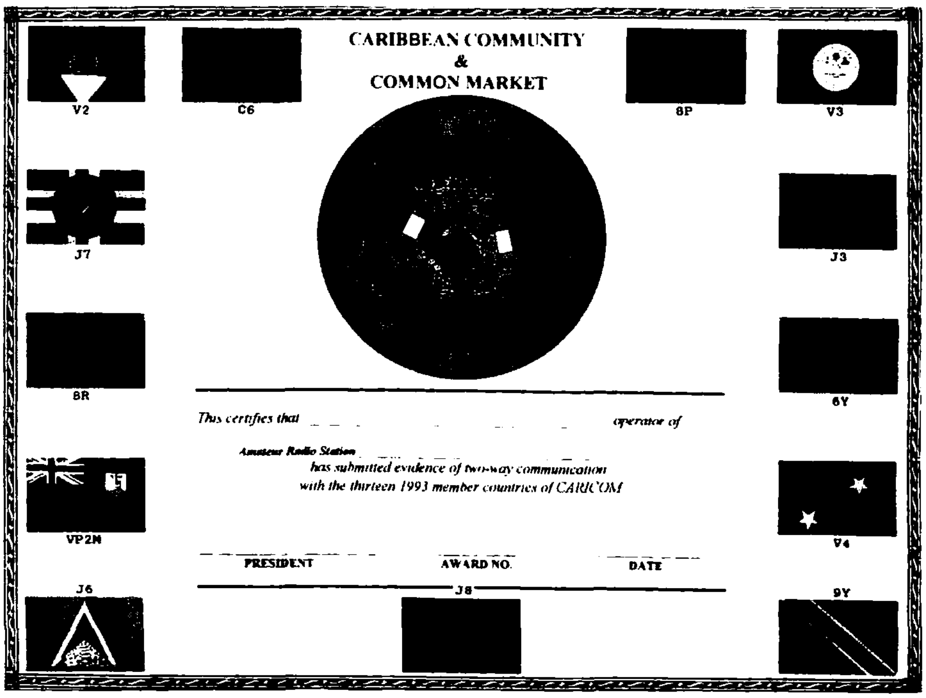


Photo A. Certificate from the Caribbean Community & Common Market.

Photo B. Paicu Marin, YO4DCF, QSL Manager for the Braila 625 Award.

nosky K1BV: Paicu Marin YO4DCF activated the special callsign YRØDCF in May 1993 to help his city, Braila, Romania, celebrate the 625th anniversary of its founding. The callsign will continue to be active through May 1994.

The Braila 625 Award is issued for working Braila stations after 1 May 1993. The following requirements are included: Class I Europeans need five contacts, all others four; Class II Europeans four, all others three; Class III Europeans three, others two. Braila DXCC members count for three contacts. Endorsements for any mode or band. SWLs OK on a heard basis. Certified lists of contacts and fee or seven IRCs to: Paicu Marin YO4DCF, PO Box 49, Braila-1, R-6100 Romania. *[Ted Melinosky K1BV, HCR 10 Box 837A, Spofford, NH 03462-9740.]*

St. Kitts-Nevis *Letter from Carl Herbert, St. Kitts-Nevis Amateur Radio Society:* The amateur must complete a form and return it, along with relevant documents to the Telecommunications Officer prior to visiting the country. The license fee is US $25 paid to the Comptroller of Inland Revenue.

The form is too large to reproduce in this column, but the necessary information is: full name, address, age, and occupation of applicant; evidence of nationality (copy of birth certificate, passport, etc.); class of amateur license held (photocopy) and callsign; location of operation; amateur bands, modes, and power to be operated; and a declaration that the information given is true and agree to follow the license terms, provisions, and conditions; signature.

Applications for licenses and renewals thereof shall be made in the month of January in each year and every such license or renewal shall expire on the 31st day of December in the year in which it is taken out.

[I will type a copy of the requirements and put it in Area 12, 73 International, of the 73 BBS, 603-924-9343, 300-2400 bps, 8-N-1. —Arnie]

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

Quite a lot has happened since I last wrote. The most important news is that the Spectrum Management Agency (SMA, formerly the Department of Transport and Communication) is overhauling the licensing scheme in Australia (for all classes, not just amateurs). At present, there are scores of license categories, each attracting a different fee, and naturally they wish to simplify it. One of the options would have placed amateurs in the same category as CB, a move that is naturally being resisted. The Wireless Institute of Australia (WIA) was approached for its views, and many branches took the opportunity to poll their members. Since there is also a move to adopt a "market-based" system for making use of the spectrum, our bands are under threat more than ever from those with the most money. *[Does this sound familiar to U.S. hams, 220-222 MHz being taken away for commercial purposes?—Arnie]*

In light of this, you would think that the WIA would unite against a common foe, but in the case of the NSW Division at least this is not so. It is impossible to fully describe some of the events that have happened recently, but some of the highlights include a packet radio BBS being "dismantled" because of an alleged defamatory message upon it; police being called to arrest broadcast personnel (nothing came of it); police called to Council meetings; broadcast facilities disabled to the extent of removing microphones, fuses, tuned feeders, etc., because of an alleged unauthorized broadcast; various BBSs being ordered to stop forwarding to certain other BBSs; a huge vote of No Confidence in the NSW Council which appears to have been ignored by those to whom it was directed; the list goes on! By the time this appears in print, the NSW Division would have had its Annual General Meeting, at which 18 people were standing for nine positions, so hopefully sanity will return to this part of Australia!

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2AAB.SYD.NSW.AUS.OC" and "dave@esi.COM.AU" respectfully. Note that my packet address has changed, since VK2RWI was one of the casualties in the aforementioned fracas.

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D. Negev 85530
Israel

ISRAELI MUSIC REQUEST FROM SPACE—As our faithful readers are aware, ongoing contacts on 145.550 MHz take place between the cosmonauts of the Russian *Mir* space station and a few hams in Israel, mainly 4X4LF Shlomo on packet, and Mark 4Z4KX, a native-Russian speaker, on voice. When *Mir* is overhead, one may often hear Mark and one of the cosmonauts chatting away.

Followers of Israeli popular music know well the name Ofra Haza, a singer who has made a name for herself, especially in Europe. Nonetheless, Mark 4Z4KX was rather surprised when Cosmonaut Alexander Serebrov RØMIR, on one of his overhead QSOs with him, asked Mark to send a greeting to Ofra. Alexander related that he is a fan of hers and asked Mark to see if he could get a cassette of hers for him.

No problem! As the ham connection goes, 4Z4XC Yair Haza is Ofra's brother, and has promised to procure her latest CD, which will have to be transcribed to cassette, as all they have on board the *Mir* is a cassette machine.

NEVER SAY DIE

Continued from page 4

last thing a company needs is a growing bunch of unhappy hams taking advantage of their ability to be heard and passing the word of what's happened to them to warn off prospective customers. Companies soon discover what a small world this hobby really is.

For instance, I know at least one ham who is busy day and night telling anyone who will listen what happened to him when he bought a piece of used equipment and called the manufacturer to get some information. "We don't support that old model anymore. We no longer have any information or repair parts."

And another ham is complaining about buying a piece of equipment, only to discover there were some software problems. He called the company and was told that they'd sent free software updates to those who'd bought his model, but only those with more recent serial numbers. His number was just beyond the cutoff, so he could pay for the upgrade if he wanted, but otherwise, lough. Yes, they knew the equipment didn't work right with the old software. And yes, they'd probably received his registration card, but they don't keep any record of those.

I've watched too many ham manufacturers go out of business through such carelessness. Criminal carelessness. I keep leaning on you readers to talk about something more interesting than the make of your rig and antenna. Well, when a manufacturer screws a ham customer, he's going to talk about that for weeks to come and a lot of other hams are going to hear him . . . and avoid the company like poison.

I'll tell you what. If you have a legitimate gripe about some company in the ham industry and they're ignoring you, just let me know what's happened. I've asked for input like this in the past and gotten piles of mail. The discouraging part of it is that when I looked into the complaints I found that about 80% of them were cases where the complaining hams were at fault, not the companies. No one has ever done the needed research to find out whether crazy people become hams or whether becoming hams makes them crazy. All we know is that the two sure tend to go hand in hand more often than we like to admit. Maybe it's the code that does it. Since Extra Class hams seem, on the average, to be the craziest of us, I've often wondered about that. If you think I'm exaggerating, just ask your wife for a reality check. You're not going to like what she has to say about your ham buddies.

Things You Can Talk About

There really are some things you can talk on the air about other than the weather or a brainless list of your ham gear. All you have to do is read a few magazines and clip out some of the more interesting items. For instance, here are some items I've put into my clipping file just in the last few days.

Time says that new findings suggest that homosexuality seems now to be an inherited propensity passed on most often on the mother's side of the family. I infuriated at least two militant ham gays by opining this in my editorial. There now seems to be an agreement that the Mayas self-destructed via infighting, overpopulation, and the destruction of the rain forests. The main reason the superconducting supercollider was doomed was the cost escalation from $5 billion to $11 billion. At five bil I thought that was a lousy investment.

Thomas Sowell, in a *Forbes* column, pointed out that Hispanics have a lower mortality rate than non-Hispanic whites, even though a great proportion of them are living in poverty and without health insurance. He points out that Americans of Filipino, Chinese, and Japanese ancestry all receive less prenatal care than whites, yet have lower infant mortality rates than whites . . . and that Mormons live 10 years longer than other whites. Hillary isn't going to like that. Have you read Sowell's blistering indictment of our school system in his *Inside American Education—The Decline, The Deception, The Dogmas*?

Also in *Forbes* was a column by Nelson pointing out that zoning is more a matter of politics than planning, and is the toot in the door tor government control of more aspects of our lives.

Newsweek cited the failure of busing in ending segregation. After years of expensive court efforts to end segregation in schools, the situation has never been worse.

A *U.S. News* survey showed that 60% of Americans agree that things are deteriorating rapidly in the United States. 80% believe that any additional tax money would just be wasted.

A *Business Week* note says surveys show that good-looking people earn more money. How much are you doing to take the best advantage of what nature (and your folks) gave you for starters? Most people get into rigid habits in their hair styles, makeup, and dress, and these are often far less than optimum. No one has to be fat. I was fat from my teens until 20 years ago. Then I decided to change and I took off 85 pounds, a couple of pounds a week. And I've kept it off. If you read the day-by-day diaries of some of my trips you'll get an idea of how I eat these days.

Did you read the *Business Week* article on the cost of crime? We're spending about $1 million to keep a 25-year-old in prison for life. Incarcerations have tripled just since 1980. "Today, the expected punishment for committing a serious crime is only about 11 days." Our overcrowded prisons have resulted in over 60,000 violent criminals being let out on probation every year. Why are so many youngsters getting into the crime business? It pays off! The average hourly pay from crime ranged from $9.75 to $19 an hour in a Boston survey. Compare that with $5.60 an hour for legitimate work.

There's an endless supply of interesting things you can talk about, and it takes only a minimum of homework to arm yourself with such items. Letterman and Leno are making a career out of commenting on the news, so how about making your contacts more fun? I've a news flash for you: The chap you're talking with could care less what kind of rig you have. He bought his, the same way you did, so what's the big deal? He also doesn't give a snap about what kind of sky wire you've put up . . . unless you've an interesting story connected to it. A very interesting story. Which is highly unlikely.

I don't know about you, but I'd be on the air a lot more than I have been this year if my last hundred contacts hadn't been terminally boring. I honestly don't even care about your lousy weather either. Now give me and the rest of hamdom a break and come up with something to talk about. If you don't, all you're going to get from me will be, "Roger on your handle. Roger on your location. Roger on my signal report. Roger on your rig. Roger on your antenna. Roger on your weather. Over."

Crawling on the Information Superhighway

Yes, CW is digital. So here we are snailing along at 20 words per minute, unchanged from the world of 1894. Fortunately most of us have our blinders on so we don't get panicked by the big trucks whizzing by us at 155 megabits per second. Hey, how many words is that?

Well, let's see. With eight bits per letter, plus a start, stop, and parity bit, and six letters per word on the average, that's 66 bits per word. That comes to 140 million words per minute. That's seven million times the throughput. Well, that's progress, so let's put our blinders back on and pretend it doesn't exist.

Put into that perspective: Our amateur radio communications are still in the technological stone ages, and that obviously includes the code test part of the license exam. We're hanging in there firmly, holding tenaciously to our 1894 technology and doing our best to ignore the real world zipping by all around us.

But if you're going to ignore today's real world, you've really got to stop griping about the unpleasant resulting artifacts . . . such as QRM and pileups. Let's say that your average 20 wpm QSO lasts about 20 minutes. That's about 200 words sent each way, and let's ignore that about half of those are wasted on sending your and his call letters, which presumably you both know once contact has been made. Thus, if you stop crawling along that 1894 forest path and get on the information superhighway over there, your whole contact could be communicated in a little over one millionth of a minute. Say, maybe we should increase the Extra Class exam to 30 wpm.

At a million wpm we could have a thousand times as many hams and still have virtually zero QRM. So here we are, with a few reason-challenged fanatics fussing over CW.

In case you haven't been doing your homework, which I'm sure is the case, that 155 megabit per second figure is what Micro Linear's new cheap Asynchronous Transfer Mode (ATM) chip is providing. See *Business Week*, 2/14/94, page 119. If you turn back to page 115 you can come up to date on MPEG and JPEG data compression protocols. That stuff is whizzing by you on that superhighway over there, oh snail or turtle. Heck, we could be sending each other full-color videos in short bursts and take up less spectrum than we are right now. They're compressing digital video by 95% these days.

Even on voice we're almost a century behind today's communications technology, with our pathetic one-way simplex transmissions. We could easily change to duplex, as I've explained several times recently in my editorials. But we're so solidly locked into our 1890's technology that no power I know of is going to get through.

Heck, back when I got started in amateur radio, in the 1930s, much of our 160m operations were duplex, with one station on the high end of the band and the other on the low end. We even had round tables of six and eight of us all sitting and chatting that way. The FCC inadvertently outlawed this when they made a law prohibiting hams from playing music on the bands. It was unintentional, but it was a disastrous new rule. But then I've noticed that most new FCC rules have unintended bad consequences.

Paving the Superhighway

While we've been squabbling with each other over our little marble game in our federally-protected playground, we've been too busy to notice the heavy construction equipment bearing down on us. Just in the past two years new orders for communications equipment have risen 53%, to an annual rate of $52 billion. Economists see this continuing for the foreseeable future. Pacific Bell and Bell Atlantic both have $15 billion planned for their networks. MCI plans $20 billion. The information superhighway system is expected to require an investment of double what we spent on the interstate highway system in the 1950s in constant dollars.

Well, big deal, right? What has that to do with amateur radio? Some of it has to do with the obvious coming need for more microwave spectrum, and we've a ton of it sitting there unused. But even more of a big deal is the fallout from any battle we might put up to save our microwave and UHF bands. That's when some questions are going to be asked for which we have, so far, no honest answers that make any sense. That's when some people are going to start asking what right we have to these billions and billions of dollars in desperately needed frequencies.

So what are we going to say? The info highway is going to provide an emergency communications system

which will make amateur radio irrelevant. How long do you think it's going to be before telephone systems no longer go out when there is a storm or an earthquake? How long before telephone systems will be able to comfortably handle 10 or even 100 times the normal traffic without failing? Take a good look at the handwriting up there on the wall and stop trying to pretend it is graffiti.

OK, if we're no longer going to be needed for emergencies, then what will be our justification for all those ham bands? At one time amateur radio was a major supplier of engineers, technicians and scientists. In the 1950s the League did a survey and found that 80% of all new hams were youngsters and that 80% of them went on to high-tech careers. Mort Kahn W2KR, who was running the ARRL at the time, put an end to that in 1963 with the so-called "Incentive Licensing" petition to the FCC, which he organized. This disaster put 90% of the school radio clubs out of business within two years, as I've mentioned more than a few times. It also wiped out 85% of the ham dealers and 95% of the ham manufacturers. And with the infrastructure that had been bringing in youngsters destroyed, our growth stopped for several years, and our pioneering of new technologies stopped at the same time. We've contributed almost nothing technologically in the last 30 years. Today amateur radio is so far behind in technology that there is no real hope of our ever catching up.

Another supposed contribution by amateur radio was our providing technically trained youngsters for the military or industry. We aren't doing that either. Today we're mainly a hobby for old, retired, cantankerous, white men. Unfortunately I'm typical. I'm old, semi-retired, white, and no one who reads my editorials will argue about my cantankerousness. As old as I am, I'm still managing to go to ham club meetings to talk where I'm one of the younger ones there.

I'm reading my mail and I'm reading all of the club newsletters we get, so I know that almost to a person, the ham world has its blinders on and is trying to ignore the real world.

Step One

Is the situation hopeless? Well, just about. Frankly, I don't see any ray of hope. Oh, we could save our bacon if we wanted to. We could easily become worth our salt and preserve our bands, but lacking even the slightest hint of leadership from the League, and ditto from QCWA, and ditto again from the Old Old-Timer's Club, there's little pressure to even consider changes. I see the OOTC and the QCWA as primarily devoted to tallying their Silent Keys. Oh, the QCWA under Harry W6ATC started to show some promise of action, but the League lowered the boom and scared the hell out of their executive committee.

Next to Mort Kahn, the old Hudson Division Director, probably the second most destructive influence on the League has, in my estimation, been my biggest (in several ways) champion, Harry Dannals W2HD. I really hate to seem ungrateful to someone who has been such a steadfast Wayne Green supporter, but I have to bow to history.

I do think that sometimes Harry gets carried away with the stories of my WWII submarine exploits, and exaggerates on how I saved *CQ* magazine from disaster in the late 1950s by investing around a quarter million (in today's dollarettes) of my own money in the magazine.

What could we do to make amateur radio worth preserving? If we'd just turn the clock back before the ARRL's "Incentive Licensing" catastrophe, where we had an 11% growth of the hobby per year and 80% of the newcomers were youngsters, we could again be a major supplier of high-tech career youngsters to our country. And this is something our country desperately needs. We need those thousands of school radio clubs back. We need a zillion Elmers. We need to scrap that stupid code test. We need advertising and PR on radio and TV.

They Can't Scuttle Amateur Radio!

Of course not. After all, we have around 500,000 hams (if we include many of the recent dead and a pile of completely inactives) and we have big investments in our equipment, right? Let's say that we have an average of $2,000 tied up in our hamshacks. If you have a calculator handy and check that out, you'll find that the sum total invested for all of us comes to around $1 billion. That may seem like a big number to you and me, but when you're dealing with congress a billion here or there is just rounded off on their calculators. Heck, the government is in debt about $4,500 billion so far, and with no end in sight. How much clout do we think one billion will have in Washington? Heck, we don't even have a lobby . . . and you can bet that all those companies who want our bands do. Companies spending $52 billion have a good deal of money to invest in lobbying.

Maybe we should hold out and get the Regional Bell Operating Companies (RBOCs) to buy our ham equipment from us. It would be one of the cheapest ways they could go to buy some invaluable spectrum.

Of course I'll admit that I'd be disappointed not to continue to talk with all those retired hams who are sitting in their hamshacks with absolutely nothing to say, waiting for their local golf courses to dry up after the rain.

I Don't Always Agree

Put up or shut up. If you don't agree with something I write, then I expect to hear from you, complete with some references proving that you've done your homework better than I have. I don't want any of the usual wishy-washy mealy-mouth nervous-nelly milquetoast emotional crapola about how, well, whine, you don't always agree with me. Stand up and be counted or shut up. 73

Number 25 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our BBS* ***(603-924-9343)****. for listings that were too late to get into publication.*

JUNE 4

ALDEN, NY The ATV Group of Western NY will launch a High Altitude Helium Balloon at 9 AM on June 4th (rain date June 5th). Live video may be received on 439.25 MHz, 2 meter CW beacon on 144.34 MHz, and local 40 meter net, starting at 8:30 AM on 7.227 MHz +/- ORM. Overlay on video will display call sign of WA2CXW, along with other info. For details, call *Roger Garbacz WA2CXW, (716) 937-4478.*

KITCHENER, ONT., CANADA The 20th Central Ontario Amateur Radio Fleamarket will be held at Bingeman Park. Contact *Jack Knight VE3RGY, 35 Brockville Ave., Guelph, Ont. Canada N1E 5X5. Tel. (519) 823-1358.*

KNOXVILLE, TN A Hamfest will be held from 8 AM-4 PM at Tennessee Valley Fair Grounds-Chilhowee Pk. Sponsor. RAC of Knoxville. VE Exams. Talk-in on 147.30+ RACK Rptr., and 224.50+. Dealers contact *Angela Cngger N4RPR, 2707 Pine Hill Dr., Knoxville TN 37932. Tel. (615) 694-9071.* For info. contact *Ross A. Ramsey KC4YDR, 790 N. Cedar Bluff, Apt 1111., Knoxville TN 37923. Tel. (615) 690-1520.*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. in Teaneck. Pre-registration required for Flea Market spaces w/power; Contact *Jim Joyce K2ZO, (201) 664-6725.* VE Exams; contact *BARA VE Hotline. (201) 797-0151 before 10 PM.* Talk-in on 146.190/.790; 145.620 simplex.

JUNE 5

EVANSVILLE, IN The Tri-State ARS will hold their 47th Hamfest/ Electronic/Computer Show at the Vanderburgh County 4H Center, Boonville-New Harmony Rd, starting at 8 AM (set-up at 7 AM). Talk-in on 147.15/146.79. Contact: *Charlie Apfelstadt N9GWS, TARS, P.O. Box 4521, Evansville IN 47724. Tel. (812) 477-7716.*

MANCHESTER, MI Chelsea ARC, Inc., will hold the 16th annual Chelsea Swap 'N Shop at Chelsea Fairgrounds, beginning at 8 AM. Set-up 6 AM. Talk-in on 146.980/R. For info. send SASE to *P.O. Box 325, Manchester MI 48158;* or call *Gary R. Widmayer, (313) 428-9398.*

NEWINGTON, CT The Newington Amateur Radio League will sponsor an Amateur Radio/Computer Flea Market from 9 AM-1 PM (dealers 8 AM), at Newington H.S. on Willard Ave. ARRL HQ/W1AW Open House. VE Exams by pre-registration only; SASE to *Susan Fredrickson WM1B, P.O. Box 165, Pleasant Valley CT 06063.* Talk-in on 145.45, 146.52 simplex, 224.84 and 443.05. For info, send SASE to *Al Gerke N1JWF, c/o NARL, 63 N Washington Ave., Plainville CT 06062-1921.*

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds, starting at 6 AM. Talk-in on 146.355/.955. For details, contact *Bruce Burton KU9A, or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Tel. (815) 795-2201.*

SALINA, KS The Central Kansas ARC will sponsor its annual Hamfest 8 AM-3 PM, in the 4H Bldg. at Kenwood Park. Flea Market. Commercial Booths. Contact *Larry White KB0BH, 336 Sunset Dr., Salina KS 67401. Tel. (913) 827-3737.*

JUNE 11

ATHENS, GA The Athens RC will sponsor a Hamfest from 9 AM-3 PM at Bishop Pk, Sunset Dr., off US 129. Flea Market. VE Exams at 9 AM. Talk-in on 146.745. Contact *George Keltey WB4VNT, (706) 546-7713* or *Rodney Couch KE4ANM, P.O. Box 6337, Athens GA 30604. Tel. 1-800-959-8273.*

BANGOR, ME A Hamfest will be held from 8 AM-1 PM at Harmon Elementary School. Flea Market. ARRL VE Exams for all classes. CW Contest. More. Sponsored by Pine State ARC. Talk-in on 146.34/.94. Contact *Roger W. Dole KA1TKS, RR#2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.*

GOSHEN, CT A Special Event will be held at Goshen Fairgrounds beginning at 8 AM. Set-up 6:30 AM. Talk-in on 147.285, 146.850. For table space, call *Sid K1SS, (203) 364-0480.* Sponsor: Southern Berkshire ARC.

LOVELAND, CO The Northern Colorado ARC will sponsor "Superfest XVI" at the Larimer County Fairgrounds, 700 S. Railroad, from 8 AM-3 PM. For details on VE Exams, contact *Rick Hubbard WA0DDC, (303) 353-3577.* For table reservations, call *Orlin Jenkins K0OJ, (303) 353-7094.* General Info: *Musser Moore AA0PB, (303) 221-3698.*

NORWICH, CT A Ham Radio Auction will start at 10 AM at Bozrah Moose Lodge on Fitchville Rd. (Set-up at 9 AM.) Bring your gear to sell (10% commission to RASON). Sponsored by Radio Amature Soc. of Norwich. Contact *Rick KD1LC, (203) 376-2216;* or *Tony N1MQS, (203) 859-2041.*

JUNE 11-12

SAN LUIS OBISPO, CA The 1st Filipino-American Ham Radio Grand Eyeball QSO will be held at Lopez Lake Rec. Area. For details, contact *AB6BX,*

(213) 257-1084. For a special QSL, send QSL to AB6BX. Talk-in on 7.155 +/-, 146.610 (-.600) pl 103.5, 147.510 simplex; 223.460 simplex; 447.000 (-5) open, 446.000 simplex; 1285.550 (-12) pl 167.9, 1294.500 simplex.

JUNE 12

AKRON, OH The 27th Goodyear ARC Hamfest and Family Picnic will be held at Wingfoot Lake Pk. Flea Market from 8 AM-4 PM (set-up at 7 AM). Please reserve tables in advance. For tickets and info, write w/SASE, or call, *David Hyde W8LFX, 1821 Cromwell Dr. Apt. B, Akron OH 44313-5546; (216) 796-5685.* VE Exams, walk-in only; check-in by 10 AM. Bring original and copy of license, plus photo ID. Talk-in on 146.385/.985 WA8UXP (until 1 PM).

COVINGTON, KY "HAM-O-RAMA 94" will be held by the Northern Kentucky ARC at the Erlanger Kentucky Lions Park. Admission 8 AM. Set-up 6 AM. ARRL, Packet and Antenna forums. Flea Market. Contact *KC4FET c/o NKARC, P.O. Box 1062, Covington KY 41012*; or call *(606) 341-1213.* Talk-in on 147.255+ or 147.375+ Rptrs.

GRANITE CITY, IL The Egyptian Radio Club (W9AIU) will hold its annual EGYPTIANFEST from 6:30 AM-2 PM, at the campus of Belleville Area College, located on Maryville Rd. and Illinois Hwy. 203. The indoor dealer area will open at 8 AM. VE Exams, pre-registration required; contact *Eric Koch NF0Q, (314) 723-0840*, or for Metro St. Louis, call *946-0948* to pre-register. Talk-in on the ERC-W9AIU 146.76 Rptr. Dealers contact *Hamfest Chairman, P.O. Box 562, Granite City IL 62040* or call *Larry Walton NZ0P, (314) 524-3254.*

HANOVER, PA The Hanover Area Hamming Assn. and the Pleasant Hill Fire Co. will co-sponsor the "Pleasant Hill Computer and Hamfest," at the Pleasant Hill Fire Co. carnival grounds (5 miles south of Hanover). General admission at 8 AM (set-up at 6 AM). VE Exams start at 8 AM; Contact *Bill NZ3J, (717) 359-7090*, or *Pat WW3U, (717) 632-4237.* For info and advance table registration, contact *Ralph Stoffel N3KZS, 5219 Hanover Pike, Manchester MD 21102. Tel. (410) 239-4918.*

OLD WESTBURY, NY An outdoors Hamfest, sponsored by the Long Island Mobile ARC, will be held 9 AM-4 PM at New York Inst. of Tech. Flea Market. VHF tune-up clinic. Talk-in on 146.25/.85. Contact *Neil Hartman WE2V, (516) 462-5549.*

WILLOW SPRINGS, IL An ARRL-sanctioned Hamfest will be held at Santa Fe Pk., 91st and Wolf Rd., starting at 6 AM. This is the 37th annual Hamfest sponsored by the Six Meter Club of Chicago, Inc. Flea Market. Please register in advance. Large Swappers Row. Get advance tickets from *Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441.* Dealers, contact *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516. Tel. (708) 963-4922.* Talk-in on K9ONA at 146.52; or K9ONA/R, 146.37/.97.

WINFIELD/CENTRAL, PA The SVARC and Milton ARC will sponsor a Hamfest at Winfield Fireman's Grounds. Talk-in on 145.18/78 and 146.82/.22. Contact *SVARC, Inc., Box 73, Hummels Wharf PA 17831. Tel. (717) 473-7050. Packet: WY3M @ NR3U.PA.*

JUNE 17-19

RED DEER, ALBERTA, CANADA The Central Alberta Radio League will host their 24th annual Picnic and Hamfest at the Burbank Campsite, approx. 8 km NE of Red Deer. Activities and displays. Talk-in on 147.150+ MHz, or 146.520 simplex. Contact *Bob VE6BLD, Box 1091, Lacombe Alberta, Canada T0C 1S0. Tel: (403) 782-3438. Packet VE6BLD @ VE6RDR.AB.CAN.*

JUNE 18

CORTLAND, NY The 12th annual Cortland International Hamfest will be held from 7 AM-3 PM, at the Cortland County Fairgrounds. Flea Market. VE Exams (reg. 9 AM-10 AM, exams at 10 AM). Talk-in on 147.780/.180. Contact *S.A.R.C., P.O. Box 5241, Cortland NY 13045. Tel. (607) 756-6550 eves. or wknds.*

DES MOINES, IA A Ham/Puter-Fest will be held at Valley H.S. in West Des Moines, by the Des Moines RAA. Doors open 8 AM-2 PM. Flea Market. Set-up at 6 AM. Seminars. Forums. VE Exams at 8 AM (registration 7:30 AM). Contact *DMRAA Ham/Puter-Fest, P.O. Box 88, Des Moines IA 50301*; or call *Mark, (515) 255-6131.*

DUNELLEN, NJ The Raritan Valley RC "94 Hamfest" will be held at Columbia Park (near intersection of Rt 529 and 28). Time: 7 AM-2 PM. Talk-in on 146.625/R, 146.520 simplex. Contact *John Manna WA2F, (908) 722-9045 before 8 PM.*

MIDLAND, MI The 19th annual Hamfest, sponsored by the Midland ARC, will be held at Midland Comm. Center. VE Exams. New and used equipment. Doors open 8 AM-1 PM. Talk-in on 147.00+. Contact *MARC Hamfest, P.O. Box 1049, Midland MI 48641.* Please SASE; or call *(517) 832-3053* eves. and wknds.

JUNE 18-19

SPOKANE, WA A two day Hamfest will be held at Spokane Interstate Fairgrounds, Sat. 9 AM-5 PM; Sun. 9 AM-1:30 PM. Set-up Fri., June 17th. Contact *Ivan Brown, E. 537 Nebraska, Spokane WA 99207. Tel. (509) 489-2667.*

JUNE 19

CAMBRIDGE, MA A Tailgate Electronics/Computer/Amateur Radio Flea Market will be held from 9 AM-2 PM at Albany and Main St. This event will be sponsored by the MIT Radio Soc. and the Harvard Wireless Club. Talk-in on 146.52 and 449.725/444.725 - pl 2A W1XM/R. Mail advance reservations before June 5th to *W1GLS, P.O. Box 82 MIT BR., Cambridge MA 02139. Tel. (617) 253-3776.*

CROWN POINT, IN The Lake County ARC will present their 22nd annual Dad's Day Hamfest at the Lake County Fairgrounds. Doors open at 8 AM (set-up at 6 AM). VE Exams at 9 AM. Talk-in on 147.00+. Contact *Ken Brown KE9TC, 918 Chippewa Dr., Crown Point IN 46307. Tel. (219) 663-5035.*

FREDERICK, MD The Frederick ARC will hold its Annual Hamfest on Father's Day, at the Walkersville Firemen's Carnival Grounds. Hours: 8 AM-3:30 PM. Talk-in on 147.06/+, 146.52, and 448.425/-. Write to *Frederick Hamfest, P.O. Box 1260, Frederick MD 21702*; or call *(301) 695-2633 - Code #6393.*

MONROE, MI The Monroe County Radio Communications Assn. will hold the "Monroe MI Hamfest" at Monroe County Fairgrounds 8 AM-2 PM. For advance tickets, contact *Tom Cooper N8OSC, 2277 W. Sterns Rd., Temperance MI 48182; (313) 847-6549.* To reserve table or trunk space, contact *Judy Kraatz, 2275 Nadeau Rd., Monroe MI 48161. Tel. (313) 289-2638 eves.* For info, call *Fred Lux WD8ITZ, (313) 243-1053.* Talk-in on 146.72/.12.

JUNE 20

SANTA MARIA, CA The annual Santa Maria Swapfest will be held at the Unocal's Newlove Picnic Grounds, 9 AM-4 PM. Sponsor: Satellite ARC (W6AB). Talk-in on 146.34/.94 WB6IIY/R. For details, call *KD6VLZ or KD6VMA*; or write to *Santa Maria Swapfest, P.O. Box 2067, Orcutt CA 93457-2067.*

JUNE 25-26

ENGLEWOOD, NJ The Englewood ARA will conduct their 35th Field Day Exercise June 25th and 26th, in order to test emergency communications from field locations. The Mayor of the City of Englewood has proclaimed June 19th-June 25th as "Englewood Amateur Radio Assn. Week."

JULY 4

HARRISBURG, PA A Hamfest will be held by the Harrisburg RAC, 8 AM-2 PM (Set-up at 6 AM). Location: Bressler Picnic Grounds. Contact *Steve Gobat KA3PDQ, 1600 Old Trail Rd., Etters PA 17319; (717) 938-6943.*

SPECIAL EVENT STATIONS

MAY 15-JUNE 30

HUDSON, FL Three ships of World War II vintage will participate in the LAST WORLD WAR II CONVOY 1994, to celebrate the 50th Anniversary of the Invasion of Europe: SS Lane Victory, SS John W. Brown, and the SS Jeremiah O'Brien. There will be a Special Events Station on board the SS Lane Victory (W6MWO). These ships will contact the Maritime Mobile Net daily, advising them of the time and frequencies of operation. For OSL cards with ship's photos, send your QSL info with an SASE to *Radio Room, SS Lane Victory, P.O Box 629, San Pedro CA 90733-0529.*

JUNE 4-5

BRANTFORD, ONT., CANADA The Brantford ARC will operate VE32BA, 1400Z-2000Z June 4-5, from the Bell Homestead, to commemorate the 120th Anniversary of Alexander Graham Bell's invention of the telephone (hence the microphone) at the site in the Summer of 1874. Frequencies: 7.170, 14.170 and Club Rptr. 147.150. For a certificate, send QSL and 9"x12" SASE to: *The Brantford ARC, P.O. Box 25036, Brantford ONT, Canada N3T 6K5.*

JUNE 10-11

MT. VERNON, NY The Westchester Emergency Comm. Assn. will sponsor the "American Cancer Soc. Overnight Relay" at 2100Z June 10th-2100Z June 11th, in Dobbs Ferry NY. Station WB2ZII will operate 25 kHz above each Novice frequency. Send OSL's to *WECA Special Event, P.O. Box 831, N. Tarrytown NY 10591-0831.*

JUNE 11

BROOKLYN, NY The Kings County Repeater Assoc. ARC will operate WA2ZWP 1400Z-2000Z to celebrate the Anniversary of Ft. Hamilton Army Base. Frequencies: 28.343, 21.343, 14.343, 7.243, 3.943. For a certificate, send a 9"x12" SASE to *Charlie Quartana N2JZA, 2175 East 8th St., Brooklyn NY 11223.*

JUNE 12

ST. FRANCISVILLE, IL The Radio Amateur Downstate Illinois Organization will operate club Station WD9GTW 1200 UTC-2100 UTC, in conjunction with the Mt. Carmel Airport Appreciation Day. Operation will be on General phone subbands on 15, 20, and 40 meters, 28490 on 10 meters and 146.490 Mt. Carmel Rptr. For a certificate, send SASE with QSL to *MCPA, RR 1 Box 54, St. Francisville IL 62460.* For info, call *(618) 948-2413.*

JUNE 18-19

PONTIAC, MI Oakland County ARS will operate W8TNO from 1200Z June 18th-0200Z June 19th, to celebrate the World Cup Soccer event being held indoors at the Pontiac Silverdome. Operations will be in the lower General phone subbands on 20, 40, and 80, and in the Novice 10m phone subband. For a certificate, send a 9"x12" SASE or IRQ's to *OCARS, P.O. Box 431-244, Pontiac MI 48343-9998.*

VANCOUVER, WA Members of the Clark County ARC will celebrate the 1st annual "VANFEST" (Vancouver Festival), by operating from their homes, using the Club call W7AIA. Operation will be in the General portion of the 75, 40, 20, and 15 meter bands, and in the Novice portion of the 10 meter band. A QSL or certificate will be available for a SASE to *CCARC P.O. Box 1424, Vancouver WA 98668.*

WESTON, WV Station KC8BK will operate 1200Z-2100Z Sat. and Sun., from the Stonewall Jackson Lake Sport and Water Show. This Station will be sponsored by the Central ARA to commemorate the 131st Anniversary of West Virginia becoming the 35th state. Operation will be in the General SSB portion of the 15 to 40 meter bands, and the upper portion of the 10 meter Novice SSB subband. For a certificate, send a QSL and a business size SASE to *C.A.R.A., P.O. Box 1487, Weston WV 26452.*

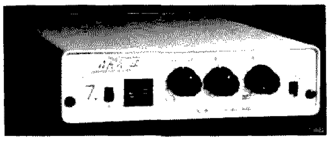
JULY 3

RUSSIAVILLE, IN The Kokomo ARC will sponsor a Special Events Station honoring the Sesquicentennial celebration of Howard County. Operation will be on 80, 40, and 20 meters in the bottom 25 kHz of the General class bands, and in the 15 and 10 meter Novice class bands. The station will be on the air at 1400 UTC and will continue for 12 hours. Please QSL w/SASE to *Dick Elliot N9IPA, P.O. Box 128, Russiaville IN 46979.*

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

S & S ENGINEERING

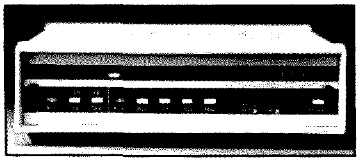


The newest member of the S & S Engineering product line, the ARK4, is the ultimate in a low cost, synthesized amateur radio rig. It's small and portable, easy to build, has top quality components, and it's guaranteed to work. This model is available in several versions, so you buy as little or as much as you need. Kit prices start at only $99.95 for the Synthesized Transmitter, with a full Transceiver (including case) for $199.95. The ARK4 Transceiver, including all options and case, is also available assembled for $269.95.

The ARK4 is one board—no wiring! It tunes in 1 kHz steps synthesized, and finer steps are crystal-controlled. No drift! You can accurately tune the entire 40 meter CW band. Power is 3-4 watts at +12V. The kit contains a MIL quality, glass-epoxy, fully silk-screened PC board and all component parts to assemble whichever version of the ARK4 you desire. All coils and transformers are prewound.

The ARK4 Transmitter is synthesized using a PLL design and has a built-in T/R switch. The Receiver is a superhet single-signal design. The Transceiver features full QSK, sine wave sidetone, and immediate recovery AGC. The fine tune is crystal-controlled and the control has detents so the frequencies are repeatable. The RIT option tunes +600 Hz. The case is steel and extruded aluminum with silk-screened front and rear panels. The Curtis chip keyer is designed right into the PCB. The fully-built complete unit weighs only 25 ounces, including all possible options.

For more information contact *S & S Engineering, 14102 Brown Road, Smithsburg, MD 21783; (301) 416-0661; FAX (301) 416-0963*. Or circle Reader Service No. 202.



KANTRONICS

G-TOR, a new mode for the KAM Plus and KAM Enhancement Board, is now available from Kantronics. This error-free mode can reliably transmit data at more than twice the speed of Pactor under most band conditions. G-TOR operates at 100, 200, or 300 baud, automatically adjusting the speed as necessary, based on band conditions. Huffman compression and run-length encoding contribute to G-TOR's speed. Errors are easily corrected through the combination of Golay forward error correction and full-frame data interleaving. Together in G-TOR, these techniques combine to provide fast, error-free data transmission in a mode that resists interference and reduces multi-path effects.

G-TOR is now standard in the KAM Plus and KAM Enhancement Board at no extra cost and is available as an inexpensive EPROM upgrade for the KAM Plus or KAM with Enhancement Board.

For more information visit your favorite dealer or contact *Kantronics, 1202 E. 23rd Street, Lawrence, KS 66046; (913) 842-7745; TELCO BBS (913) 842-4678; FAX (913) 842-2021.* Or circle Reader Service No. 204.

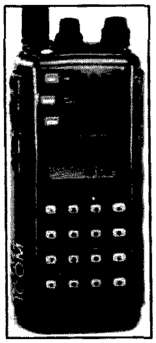
DAVIS ASSOCIATES, INC.

Davis RF Co. announces the availability of their new "Club Discount Catalog." This new catalog features "Flex—Weave" hybrid aerial wire, DSP audio and noise filters, high-quality coax and wire antenna parts, vertical phasing, baluns, Vibroplex Bencher, B & W, and sundry accessories. The unique aspect of this new club catalog is that it provides amateur radio club members with an easy way to obtain discounts.

All a club member needs to do is have one other club member order with him or her a minimum of $150, or three members on an order need only order a minimum of $100. The "Club Catalog" can be obtained by sending three 29-cent stamps, deductible with order, to the address below. Please specify "Club Catalog." For more information and to order contact *Davis RF Division, Davis Associates, Inc., P.O. Box 230, Carlisle, MA 01741; (800) 328-4773, (508) 371-1356, FAX (508) 369-3484.* Or circle Reader Service No. 205.

DAVIS RF

ICOM



Icom has introduced the new IC-T21A VHF and IC-T41-A UHF handhelds. Packed with innovative new features, these transceivers utilize elastomer construction on the side panels for a grip contoured to fit comfortably in your hand. Combined with a lightweight (11.1 ounce) and compact (2-1/16"W x 4-1/4"H x 1-1/4"D) design, the IC-T21A and IC-T41A are a pleasure to use, even during long hours of operation.

The IC-T21-A transmits and receives on 144-148 MHz; the IC-T41A on 440-450 MHz. Both have dual-band receive capability for full-duplex crossband operation between the 2 meter and 70 centimeter bands.

For further information visit your local Icom dealer or contact *Icom America, Inc., 2380 116th Ave. NE/P.O. Box C-90029, Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

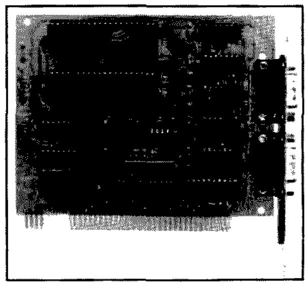
R.L. DRAKE

The R.L. Drake Company proudly announces a new addition to their shortwave communications receiver line—the SW8! The SW8 shortwave communications receiver is a microprocessor-controlled, synthesized, world-band communications receiver. A unique and exciting feature of the SW8 is that while it offers the sophistication of a desktop shortwave receiver, it also allows the listener to take quality listening gear wherever he chooses.

The Drake SW8 can be operated either with the supplied AC adapter, or by six "D" cell batteries. It offers continuous-coverage capability from 500 kHz to 30 MHz, which includes the AM broadcast and shortwave bands. Reception modes include AM, AM synchronous, SSB, and FM broadcast band (87-108 MHz). Drake has set the standard for clarity of reception and audio quality.

This receiver is priced at under $600. For more information contact *R.L. Drake Company, P.O. Box 3006, Miamisburg, Ohio 45343; (513) 866-2421, FAX (513) 866-0806.* Or circle Reader Service No. 203.

SEALEVEL SYSTEMS, INC.

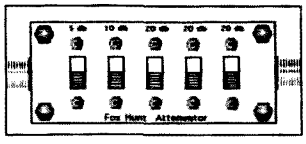


Sealevel Systems has introduced a low-cost Windows-compatible RS-232 interface card that will be of interest to HamWindows operators. HamWindows typically requires multiple serial ports for connecting additional peripherals to their computer-based rigs. Most multi-port serial interface boards either do not support the specific hardware requirements of Windows, or they may be extremely expensive. The Sealevel Duocom solves the HamWindows communications challenge by providing a low-cost American-made two-port RS-232 interface.

The unit is designed for PC/XT/ATs and compatibles. It provides the user with two additional Windows/DOS compatible serial ports for modems, printers, terminals, etc., with extended interrupt support.

This product offers many features, and is priced at $89. For more information contact *Sealevel Systems technical support, P.O. Box 830, Liberty, SC 29657; (803) 843-4343.* Or circle Reader Service No. 207.

ARROW ANTENNA



Arrow Antenna announces the Fox Hunt Attenuator—a five-step attenuator with 75 dB in 5 dB steps. This RF attenuator box is designed for radio direction finding.

The box is made from double-sided Fiberglas PC board. The five pi-network resistive sections use full-size slide switches with gold contacts. The box measures 4-3/4"L x 1-7/8"W x 1-1/4"D, not counting switches and connectors. The unit is available with either BNC or UHF connectors.

The Fox Hunt Attenuator is available fully assembled for $49 plus shipping ($3 US, $5 Canada). For more information or to order contact *Arrow Antenna, 1461 Peacock Place, Loveland, CO 80537.* Or circle Reader service No. 206.

73 Amateur Radio Today

JULY 1994
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73 Amateur Radio Today

July 1994
Issue #406

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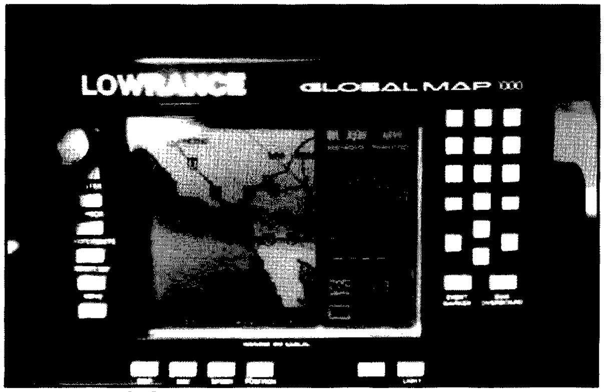

Load your marine GPS receiver with highway maps and know where you're going! Turn to page 10. (Photo by Gordon West WB6NOA.)

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Hit the trail with the Icom GP-22 GPS receiver. See this month's cover story, "The Global Positioning System," starting on page 10. (Photo by David Cassidy N1GPH.)

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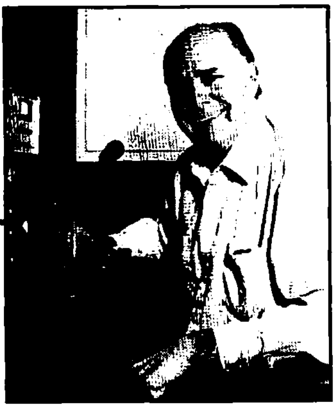
Contract: Under the power vested in me by the almighty Oz, I command you to get a life! Listening to your endless, mindless rig babble is boring. Don't be a broken record. Get off your center of gravity and try something new.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Here They Go!

Yes, I know you're busy fighting the pileups on 20m and could care less about our 2400 MHz band. You're focused on the here and now and don't want to be bothered about five or 10 years from now. Let the future take care of itself.

The only reason we have our country is that a bunch of fanatics fought for it a couple hundred years ago. They believed in what they were doing. I'm sure glad there's no way for them to see what a mess you've made of their vision and hopes. Yep, you. You're the man. You're the one who has been reelecting your crooks to Washington, and it's Congress that's made the big mess we're trying to cope with.

Well, Congress is at it again. This time they're grabbing 25 MHz of one of your unused UHF bands and putting it up for auction, with the proceeds to go toward supporting even more Congressional pork. They'll get billions for it.

Our 2390-2450 MHz band is the first on the block, with recommendations for selling off the 2390-2400 and 2402-2417 segments. They're graciously planning to leave us the 2400-2402 segment for our satellite communications. They've also targeted 2300-2310 for later sale. That'll carve 35 MHz from our 70 MHz allocation. Hatt!

In a few years we'll either have a healthy amateur radio hobby which is largely satellite oriented or we'll be a vague footnote in the history books. The world is going high-speed digital and leaving us behind in the dust.

So what can you *do* about all this? Probably not much. You've bet the farm on the ARRL and they're unlikely to take any action that could change things. Congress is run by bribes, with the biggest bribes going to the subcommittee members. Let me be blunt . . . how much money have you personally donated to your congressmen's reelection fund? I'm willing to bet that all 500,000 of the hams who may still be alive have donated well under $50,000. Ten cents a head. Well, a dime may have been big money when old man Rockefeller was handing 'em out in the 1930s, but we don't even bother to lean over to pick up a dime on the street these days. With Congress you get what you pay for and not anything extra. They know you're so stupid you will continue to re-elect them, so why should they care what you think?

Now, if you could start getting some petitions going among your family, friends and co-workers, promising to unelect them if they sell off your heritage of ham microwave frequencies, we might get somewhere. It would take ham clubs in all 50 states to pull it off. One thing you can bet on, I'll be watching the ham club newsletters, looking for some signs that someone out there gives a damn about the hobby. If every ham club in the country started getting petitions signed, with copies to their congressmen and me, we might end up with bigger satellite bands instead of diced and sliced baloney.

Or you can wait for the ARRL to do something, which I doubt will ever happen.

What will I do with a ton of petitions? I've been a registered Washington lobbyist for over 20 years now, so I know exactly what to do. I've been down there before waving a sheaf of petitions and watched the reaction. That was what got us the hearing before the FCC Commissioners 20 years ago, the one which resulted in the biggest changes in ham rules in the history of the hobby. That's when we got back our repeater rights.

Yes, Congress is run by bribes, but they also are influenced by cartons of petitions. Heavily Influenced. If they get unelected they're suddenly off the lobbyist gravy train.

But heck, it's only 25 MHz of a band we aren't using, so who cares. Right? Never mind that the camel's nose is in the tent.

Poor, Dumb Wayne

A few years ago I got an interesting letter from George W9EJY proposing a ridiculous new modulation approach. Imagine being able to put a 75 MHz FM signal out on an AM broadcast transmitter! An obviously crazy idea.

But George had stirred up an idea I'd had years before . . . an idea that seemed logical, but if so, why wasn't it being used? I think I even wrote about this in an editorial maybe 20 years or so ago. So I ran the idea by a scientist friend of mine to see if he could shoot it down. He hemmed and awed.

What George has done . . . what I'd wondered about years ago . . . was taking an audio modulated FM signal and dividing it down. Let's say you want to have a nice, full frequency audio signal. We could even start with the normal 75 kHz commercial FM bandwidth, modulating it at 100 MHz, right up in the middle of the FM band. Now we divide it by 5 twice and we've got a 4 MHz signal with 3 kHz bandwidth. Any reason we can't transmit that on 75m and have one heck of an FM channel?

To receive it you'd want to multiply times 5 twice. This would take your 455 kHz IF signal and move it to 284.375 MHz. A local oscillator at 273.675 MHz would give you your 10.7 MHz IF signal for any FM receiver to detect.

Well, if we can do that for FM, how about a 6 MHz-wide TV signal? Well, we'd have to start at around 2500 MHz and divide down by 5 four times. That would again give us a 4 MHz output. but with ±9.6 kHz of modulation. Not bad for ATV on 75m, eh?

Now please tell me why this won't work. Then I'll pass the word to George, who has tested his FM idea on the air with a cooperating AM broadcast station and found it to work just fine. He's been exhibiting at the NAB conventions, looking for a sponsoring company to get involved. He's found that if the AM station keeps its AM modulation at around 85% there is no detectable interference between the AM signal and the micro-modulated FM signal on the same carrier.

As George points out, the exciters used for early FM transmitters started out at around 115 kHz with ±87 Hz phase modulation and then multiplied that up 864 times to the output channel. Sauce for the goose.

The concept was good enough to get George a Technology Award from The Society of Broadcast Engineers in 1992. But is it enough to get you to give it a try?

Progress

So here we are in 1994. And here I am using a Macintosh PowerBook for most of my work. And here I am without a simple program to keep track of and display the sales of my enterprises. This is ridiculous!

The first practical microcomputer was the Radio Shack TRS-80, which debuted in August 1977, just two years after the first micro was announced. The first was the MITS Altair 8800, but that lacked a few things. It came in kit form and had no operating software at all. A few months later Bill Gates showed up at MITS in Albuquerque with his jury-rigged BASIC. The way I recall it, he'd written a BASIC Interpreter for the 8008 chip as an exercise in his computer course at Harvard. When the Altair came along, desperately needing something to make it do more than be an expensive paperweight, he cobbled his interpreter so it would work on the 8080 chip, left school, and went to work for MITS. He's doing fairly well.

Commodore came out with a PET microcomputer in around March 1977, but it had a stupid square keyboard, and a marketing plan designed to screw any dealers who sucked into trying to sell it. My recollection is that Jack Tramiel, the president, set up his own separate mail order firm, Contemporary Marketing, in Bensenville, out near Chicago, just to sell the PETs. He refused to let Commodore run any ads for the computer, with only his mail order firm advertising. I visited the factory in California where I was told that only after his mail order company had all the inventory they needed would Commodore ship any units to dealers.

But to use the PET you had to load BASIC from a cassette, and so on. Slow. By the time Radio Shack announced their TRS-80 Model I, the customers were ready for it.

I realized that the only practical way to provide the software these microcomputers were going to need was to manufacture and sell it in quantity. Up until then we had the mainframe computers, starting in the million-dollar range, complete with horrendously expensive software, also running in the million-dollar range. Then came the minicomputers in the $100,000 bracket. The software for these systems was custom-developed for each user and also ran around $100,000 on the average. So I figured that now that we had $10,000 computer systems we were going to have to get soft-ware costs down too, and that meant mass production. That's when I started Instant Software.

My approach was simple. I got the readers of my magazines to send in software they'd developed for possible distribution. I set up a lab with around 30 work stations so we could cover the most popular micros. Incoming software was then evaluated by my people and the best of it was put into shape for production. We started out with a lunar lander, and went on to develop all kinds of games, educational stuff, and quite a few rather good business programs. Our Typing Teacher won prizes, as did our geography programs.

One of the best was Business Analysis. Though that was designed for the Model I, and later it was updated for the Model III. It was so far beyond anything I've seen since that it is frustrating. I sure wish something like that was available for my Mac. If there's a pro-

Continued on page 74

LETTERS

Number 2 on your Feedback card

From the Ham Shack

James W. Searcy WA5WRE, Poplarville MS In July of 1992 there was an amateur in Picayune, Mississippi, who came up on the local repeater there and used all kinds of four-letter words, complaining about a woman driver cutting him off in traffic. As he was spouting off over the air, I called the FCC office in New Orleans and let an FCC engineer listen for a solid five minutes. He told me that there was nothing the FCC could do, for they could not "define" what was obscene. Well, I chewed that, and after choking a few times I managed to swallow it.

Now (April 1) I've had a non-ham come up on my machine here in Poplarville, use our autopatch, and never sign. We caught the individual, called the FCC, talked to the same engineer, and were told, "There's nothing we can do, for we didn't witness the QSO." Not only that, but a business whose owner is an Extra Class amateur sold him the radio.

Well, needless to say, this upset me, but what really hurts is that word got out about the FCC's "non-action," and now one of my students has dropped out of class and is operating on amateur frequencies with a bogus call, stating, "Why worry? The FCC won't do anything to you, so why go through the headache of working for a license?"

I've been an amateur for 42 years and frankly, I've reached the point where I can't blame him. It's like going to a war without your leaders. What are you supposed to do? With no FCC backing, there is no chance of winning.

I don't operate HF at all, but if I did I think I would modify it for CB so that when the time comes I'll be ready.

James—You haven't been reading my editorials. Tsk.

As I've explained, the FCC is understaffed and underpaid, and doesn't want to be bothered with amateur radio. If we aggravate them very much they'll get more interested in ending the hobby. After all, the FCC people get no benefit from hams.

We're no longer living up to any part of our charter, so the less we bother them, the longer we'll be able to use the billions of dollars in spectrum we've inherited.

The fact is that when there is a local problem it's up to the local amateurs to take the solution of the problem as their responsibility. You can't expect the FCC to spend money to help. After all, how much money are you paying for your license? Zilch. And what else are you contributing to the commonweal? Not very much.

The best rule is not to poke the bear while it's sleeping.

73 . . . Wayne

Kevin Elliott NØVNP, on the *73* BBS Wayne, I want to thank you for a few of the things you have unknowingly given me. You and your mag, in the early small-size format, got me interested in ham radio, via the articles and your grasp of the ham community. You gave me the chance to enter through reading the various articles and, of course, your comments.

I bought your tapes in 1978 to learn Morse code. You had a rather odd idea of sending fast, with the spacing in the range needed. With me it was 5 WPM that got me into the area I thought I would not be able to attain. The numerous magazines that my Elmer gave me to read, yours and others, were what got the theory to begin to make a bit of sense. But no matter what subject I wanted to find, articles in your *73* magazine were what I came back to. Your trips and DXpeditions allowed me and others the chance to see what this hobby is all about.

I went on to get my General ticket and worked about 175 countries. Via moving and a divorce I lost about all of my gear and my QSL cards. I lost yours in a fire, and that was probably one of the most treasured of the bunch. I had the early Clipperton, Walvis Bay, on the second day they used that call, and others, but my W2NSD/1 card was at the top of the list. You were nice enough to send me a card a few months back to replace the one I lost, and I thank you.

Last Saturday I took my Advanced test, which I passed with ease, in a large part thanks to reading and learning. Even at age 41 my dreams continue, thanks to your magazine. My license was reinstated from my first call (WBØYHG) to NØVNP because I strayed from the hobby that I have grown to love. But, finding your bigger-size magazine on the newsstand one day about two years ago relit the fire that I hadn't realized had gone out.

Wayne, thanks for the memories that you have given me and for the enjoyment that each month I discover in the pages of your publication. Don't change now—I'm too old to be confused.

By the way, I am getting remarried on August 6 and my future bride will be a ham by then as well. She is taking her Tech (with code) class from a local group, and in large part I can thank you for that as well. Your editorials about education have a very special meaning to us. May all your skip be long and the scuba diving safe.

Gary Moeller N8WVV, from the *73* BBS I love your editorials. They are one of the first things I read each month when I get my copy of *73*. Please keep prodding us—heaven knows, we need someone to keep us thinking. The rest of society seems to want us to go brain dead and you are helping to keep us alive.

Irving L. Chidsey, Havre de Grace MD Wayne, I was perusing my son's copy of the April issue of *73* and noted your column on "Good Science and Bad Science." The quality of what passes for science in public discussion has long been a concern of mine. I am glad to know that it is also a concern of yours, but I am puzzled by your choice of examples, for we seem to be on opposite sides of several issues, and I would like to know what your criteria were. For most of my professional career I was part of the Rocket/Upper Atmosphere program at the Army's Ballistic Research Laboratory, classified as a physicist, or a research scientist, or a research engineer, at the whim of the personnel office. My criteria are that as much as possible I check with the refereed journals (more difficult since I retired two years ago), and that I understand the underlying science. Now that I can no longer easily read refereed journals, I use *The American Scientist*, published by Sigma Chi, *The Scientific American*, *Science*, and *Nature* when I can get them, and books published by recognized scientists. I don't own a copy of Gore's book, but if I did, I would read it to check his understanding of the issues, not to improve mine.

My reading of the scientific journals tells me that scientists are worried about acid rain and its effects on the more fragile ecosystems. The first articles about the increase in atmospheric CO_2 appeared in the *Journal of Geophysical Research*, etc., during the mid '60s, and scientists have been concerned about the probable consequences, global warming and a rise in the sea level, since the early '70s. It was also the scientists who discovered the ozone hole over the South Pole, and they have made great strides in understanding what causes it. The atmospheric science community still believes that a nuclear winter was the expected aftermath of an all-out nuclear exchange between the United States and the USSR. Frankly, I'm quite happy that we didn't try that experiment. After the Gulf War, one very earnest, very prolific, and very wrong nut flooded several discussion groups on the Internet with predictions of doom because they thought the very extensive smoke clouds from the burning oil fields would cause a Gulf War winter. There was a quite measurable cooling where the clouds persisted, about what the theory predicted, but it went away when the fires stopped. To that extent, the nuclear winter theory has been validated.

Your other examples are from fields further from my expertise, but I believe that most of them are valid concerns. I agree that the Alar scare was a panic attack that grew because the scientists hadn't done their research yet. It is true that we won't run out of oil 'til quite awhile after the turn of the century, but we now have to do much of our drilling in very dangerous and inhospitable places, and it is getting harder and harder to find major oil fields. We are losing topsoil and we are paving over, or developing, much of our best cropland; the county I live in has lost over half its farmland to development in the last 40 years. There are areas in our country where the water table has dropped several hundred feet over the last few decades. The example that comes to mind is the Ogaliala aquifer in the Plains states; on Long Island, sea water has moved in to replace potable ground water. I think that such examples can be reasonably described as using up our ground water.

Some other examples of bad science, or at least prematurely announced science that didn't pan out, are the 4th state of water, cold fusion, unlimited oil, and laetrile. Several of them were trumpeted by the press before they had gone through the scientific review process. Unfortunately, the loudest protagonists on both sides of these questions tend to be the most irresponsible, and the scientists may be left out of the public discussion.

Remember, we do our science out in the open, and in some cases the science gets communicated to the public while it is still being baked; the press likes to get its stories while they are still hot, without waiting for all questions to be threshed out in the review process. In several of these cases, the news was published too soon; the "good story" was a false lead, an error which the scientific community corrected as soon as it could. The alternative is to study the phenomena in secret, and only inform the public when all the research is done and all doubts removed. I don't think that secret science is either possible or desirable in a free society, and you would be among the first to object if it were tried. Absent carefully-controlled release of only assured results, we have to let the work in progress hang out in public and take our chances that the public will sometimes be led astray. Again, I would like to know what your criteria were for choosing your examples so I may understand why we differ.

Irving—Yes, we do differ. But if you do some homework, I think we'll be in agreement. I suggest you read Environmental Overkill *by Dixie Lee Ray, the former Governor of Washington and Chairman of the Atomic Energy Commission, Assistant Secretary of State, etc. The publisher is Regnery Gateway Commission, $20, 260 p. Then read* Ecoscam *by Ronald Bailey, St. Martin's Press, 228 p.*

These two books, plus several others I've read, all agree that the ozone hole is baloney, and ditto global warming and the coming ice age. Even the nuclear winter data has been seriously challenged in Scientific American*, as has acid rain. Ray demolishes that bugaboo, too (pages 147-150).*

Remember that no scientific issue can be resolved by strongly-held belief, no matter how eminent the authority.

You are indeed out of touch when it comes to cold fusion. Tsk! The premiere issue of "Cold Fusion" *magazine is in my hands: 100 pages, with articles by several well-known scientists. Copies of the magazine are $10, if you're interested in coming up to speed on something you believe didn't "pan out."*

You mentioned Laetrile, which makes me wonder how much you've read about it. Not much, I'll bet. How about what the AMA did to Hoxsey and to Krebiozen? You'll want to read Racketeering In Medicine, The Suppression of Alternatives *by Dr. Carter, Hampton Roads Press, $13, 360 p. Good book.*

You also might read Impure Science *by Bell, Wiley, $23, 300 p. Cheers . . . Wayne*

QRX . . .

Number 3 on your Feedback card

FCC Amends Message Forwarding Rules

The Federal Communications Commission has acted on P.R. Docket 93-85 and has relaxed the Amateur Service rules to enable contemporary message forwarding systems to operate at hundreds of characters per second while retaining safeguards to prevent misuse.

A message forwarding system is a group of amateur stations participating in a voluntary, cooperative, interactive arrangement where communications from the control operator of an originating station are transmitted to one or more destination stations via forwarding stations, which may or may not be automatically controlled.

Currently, the control operator of each station is held individually accountable for each message retransmitted, resulting in unnecessary content review and delays. The American Radio Relay League stated that the obligation of the control operator of the first forwarding station should be the establishment of the identity of the station originating the message. Only when this is not done should these control operators be held accountable for improper message content.

The commission agreed, and thus, the FCC will hold accountable only the licensee of the station originating a message and the licensee of the first station forwarding a message in a high-speed message forwarding system. The licensee of the first forwarding station must either authenticate the identity of the station from which it accepts communications on behalf of the system, or accept accountability for the content of the message. *TNX Westlink Report, No. 670, April 21, 1994.*

See The Light

A young Missouri company has announced what they say is the first fiber optic cable system for home audio and video application. Developers hope the *Mongoose* cable system will soon replace conventional wire cables carrying high-fidelity analog signals in runs of up to 2.4 miles.

Why bother? According to a company vice president, it is the best way to connect both audio and video components. "It is non-conductive, has no impedance, and neither causes nor attracts electrical noise." V.P. of Development of ASM Labs Armando Martinez foresees market demand from both amateur and professional audio and video purists. "The integrity of the original signal is uncompromised," says Martinez, adding that this is the first fiber optic system that is plug-compatible with conventional equipment.

New kHz on the Block

The Federal Communications Commission will hold frequency spectrum auctions this fall, according to Chairman Reed Hundt. The frequencies heading for the auction block are to be used to expand mobile communications, which Hundt says has the potential to become one of the country's largest industries by the end of the century, with at least 87 million customers.

Hundt also says he wants the FCC to promote competition in the communications industry, especially for cable TV, so rate regulation can eventually be eliminated. *TNX Westlink Report, No, 671, April 30, 1994.*

Brain Cells

Energizer Power Systems and National Semiconductor Corp. have developed a new battery that monitors its own power consumption and provides recharging communications with the host equipment. These "smart batteries" are expected to first appear in notebook computer applications.

The new batteries use nickel-metal-hydride and nickel-cadmium rechargeable cells. The internal brains virtually prevent overcharging and allow for useful "time-left" or "% capacity remaining" information to display on the host device.

The announcement comes at a time when portable electronics equipment use is skyrocketing. Duracell International and Intel Corp. have also joined together to develop a smart battery of their own. *TNX Electronic Engineering Times, Issue 797, May 16, 1994.*

FCC Cracks Whip

Fifty-nine Southern California hams are under order from the Federal Communications Commission to retake their amateur radio license exams or face penalties, according to a story in the *Westlink Report*. The commission says all of the licensees in question were passed at sessions conducted by the ARRL-VEC in 1992 and 1993. Those volunteer examiners are also facing government scrutiny.

In a letter sent to those licensees, the FCC flatly accused the applicants of cheating. The letter says, ". . . the irregularities on your examination papers indicate that you were apparently given access to the exact (answer) key used by the volunteer examiners."

Those who were passed at the suspect testing sessions have 60 days to retest. Those who fail would face downgrade or loss of license entirely. Refusing to retest could result in more severe penalties. So far, almost three dozen VEs have been suspended in Southern California, in connection with testing irregularities, under orders of the FCC. *TNX Westlink Report, No. 671, April 30, 1994.*

What's Your $ign?

The callsign of your dreams awaits you, and the price will be $7. That's the word from the Federal Communications Commission. On March 11, the FCC released its Notice of Proposed Rule Making to implement the new fee assessments for licensees who were authorized by the 1993 US Budget Act.

Item 59 of the NPRM notes fees for amateur "vanity" callsigns, that are to take effect whenever the commission's proposal is finally approved. The current plan calls for a fee of $70, or $7 per year for the 10-year license term. *TNX Westlink Report, No. 671, April 30, 1994.*

Top Cop

According to Electronic Engineering Times, a group of students at the Massachusetts Institute of Technology recently showed they were "complete engineers" by arranging a rather sophisticated end-of-semester prank. The article quotes Bob Rivers, Human Resource Director at Bose Corp., saying the MIT students displayed a number of desirable qualities his company looks for when hiring engineers: initiative, leadership, technical knowledge, planning and organization, and the ability to handle stress.

So, what did the students do? They somehow constructed an exact replica of a campus police car—right down to a bag of Dunkin Donuts—and lifted it to the dome of one of MIT's main buildings, all in complete secrecy. As you can imagine, the story was highly photographable, and made all the evening newscasts in Boston. Rivers says these young engineers also have another trait that is very desirable in the workplace—a sense of humor. *TNX Electronic Engineering Times, Issue 797, May 16, 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on CompuServe ppn 70310,775@compuserve.com; or at the *73* BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one-stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

The Global Positioning System

An overview.

by Bill Clarke WA4BLC

The NAVSTAR Global Positioning System, generally called GPS, is a satellite radio positioning network providing very accurate position, velocity, and time information. Although GPS, developed by the U.S. Department of Defense (DOD), can provide three-dimensional position, velocity determination, and precision time transfer, position information is the most sought. Plans call for GPS to be the DOD's primary means of radionavigation. The system is capable of serving an unlimited number of users anywhere on the ground, at sea, in the air, and in near space.

Photo A. The Trimble Navigation SCOUT GPS receiver (courtesy of Trimble Navigation, 9020-II Capitol of Texas Highway North, Suite 400, Austin TX 78759; 800-959-9567).

Parts of GPS

GPS is comprised of three parts (officially called segments): space, control, and user.

The space segment is a constellation of 24 satellites in semi-synchronous orbits at an altitude of 20,200 km (10,900 miles).

The control segment consists of a master control station located in Colorado, and five monitor stations (MS) situated around the world. As the central GPS processing facility, the control segment is tasked with tracking, monitoring, and managing the satellite constellation.

The user segment consists of the consumers of GPS. They may be military or civilian; however, all must be properly equipped with specially designed receiving equipment, normally referred to as a GPS receiver or receiver/processor, to make use of GPS.

How GPS Works

GPS position determination is based on a concept called time of arrival (TOA) ranging, which is merely the signal's travel time from transmission to reception.

A simple example of TOA ranging: The distance from a thunderstorm to your location can be figured by counting the seconds between a lightning flash and the thunder report (the TOA value). Multiply the TOA value by 0.2 (the approximate speed of sound is two tenths of a mile per second) to calculate the range in miles.

The NAVSTAR satellites are broadcast beacons transmitting L-band signals consisting of pseudorandom noise (PRN). The PRN is predetermined strings of one and zero data bits, generated by an on-board clock that also provides the exact transmit time of the signals. GPS satellites transmit spread spectrum signals on two frequencies: L1 = 1575.42 MHz and L2 = 1227.6 MHz. All radio transmissions are on the same frequencies, with individual satellite identification made via unique individual code sequences.

When the GPS receiver begins tracking the PRN sequences from four satellites (the generally accepted minimum number required to provide adequate accuracy), the receiver's data processor takes over.

The processor samples the receiver's TOA values, makes numerous calculations and corrections that account for clock errors, ionospheric signal delays, receiver noise, etc. Much of the corrective mathematics used in these calculations is variable from time to time. The variables are provided to the GPS receiver as parts of the satellite signal called the navigation message (NAV Msg).

The NAV-msg is superimposed on the satellite signals and contains: GPS system time of transmission, a hand-over word (HOW), orbital position data, clock data, and almanac data for the remaining satellites in the constellation. The coefficients for calculating UTC and the ionospheric delay are also included in the NAV-Msg.

The GPS receiver computes the position fix in coordinate terms, consisting of latitude, longitude, and altitude.

Note: A GPS position fix refers to the electrical phase center of the receiver's antenna, as the antenna is the actual point of signal reception.

The normal tracking sequence begins with the receiver determining which satellites are visible for tracking, via user-entered predictions or stored satellite almanac information from previous NAV-Msg data. If there is no almanac information, a search of the sky must be made to locate and lock onto a satellite. The receiver can then read the NAV-msg and get current almanac information about the other constellation satellites. This may sound rather complicated; however, the user can relax as the entire process is done automatically by the receiver/processor.

It's interesting to note that the typical satellite received signal level is below the earth's natural radio

noise level. After detection, the satellite's signal is multiplied by use of receiver-predicted PRN codes and with the received signal collapsed into the original carrier frequency band, concentrated, and brought well above the natural noise level.

Simply Complex

The average GPS portable receiver somewhat resembles a VHF hand-held transceiver in size and weight. Functionally, you will find the GPS receiver simpler to operate, although somewhat similar in flavor. Buttons operate selection menus and functions are selected from those menus. Referring to the Trimble Navigation SCOUT GPS Receiver in Photo A, note there are only eight buttons for control. By using the buttons and the scrolled menus appearing on the LCD display, the exact location can be determined, routes may be programmed, locations memorized, distance from previous or input locations computed, and speed calculated.

GPS Accuracy

GPS was designed to support a broad spectrum of users with differing requirements of accuracy. Basically, there are two categories of GPS accuracy service:

The *PPS*, precise positioning service, which is extremely accurate and available for use only to those authorized, and the *SPS*, standard positioning service, a less accurate positioning service which is available to all GPS users. PPS and SPS are functionally identical; however, access to the PPS is limited by encryption techniques.

PPS, primarily intended for military purposes, typically provides accuracy of 22 meters horizontally, 27.7 meters vertically, and time within 90 nanoseconds.

SPS, used for civilian purposes, is specified to provide 100 meter horizontal, 300 meter vertical, and 170 nanosecond time accuracy. The horizontal specification includes peacetime degradation of selective availability (a means of tinkering with the system to make it less accurate in the name of national security). For the SPS user, selective availability is the dominant SPS accuracy error source.

In practice, the specifications are easily attained, with much greater accuracy the rule and not the exception.

GPS Receivers

Although the technology of GPS is fascinating, it is not feasible for the average ham to construct a GPS receiver. Not that some hams aren't capable of the job—it just isn't feasible (read: worthwhile). No more so than building a 2 meter HT with all the current bells and whistles would be.

There are several types of basic GPS receivers, varying in complexity, tracking capabilities, speed of information update, and planned use. Unfortunately, corporate marketing has clouded the identity of some receiver types and operational complexities (rarely are complexities a user concern as most GPS receivers are designed for ease of operation). The types of receivers consist of:

Sequencing—This type makes use of one or two hardware (RF) channels by simple stepping from one selected satellite to another on a timed basis. Sequencing receivers use simple circuitry, and have low production costs and low power consumption. They are adequate for most purposes except high-speed navigation.

Continuous tracking—These have a minimum of four hardware (RF) channels and track four or more satellites simultaneously. They are less affected by speed than the sequencing receiver.

Multiplex (MUX)—With this type, a single hardware (RF) channel is switched at a fast rate between satellites being tracked. Switching is typically 50 times a second. The multiplex receiver is based on time sharing and requires only a single code generator and carrier synthesizer for tracking.

Digital—This type uses analog-to-digital conversion techniques with a single receiver IF for signal amplification. Signal processing is accomplished digitally. This type of receiver can be visualized as a single channel radio receiver with five digital channels, each monitoring an individual satellite.

"Now that you have been boggled by the high-tech world of GPS, you might ask, 'What's in it for me?'"

Hams and GPS

Now that you have been boggled by the high-tech world of GPS, you might ask, "What's in it for me?"

Using GPS, a ham can display his exact location and figure distances to other locations. Other locations might include previously-memorized points (locations electronically in the receiver) or latitude and longitude points entered manually.

The exact location of VHF/UHF repeaters can be determined for ease of mapping planned coverage and determination of potential interference with existing repeaters. As the GPS is a three-dimensional system, altitude can also be displayed.

Distance between known points can easily be displayed. Just push a couple of buttons and indicate the points to be referenced. Again, for repeater usage, coverage could be determined by following a line of signal strength and marking locations on a map. Distance calculations can be very important for mountaintop VHF/UHF operations.

The Maidenhead grid locator system (grid squares) is programmed into the SCOUT GPS receiver and indicates grid squares to about 75-foot accuracy. The display consists of the basic field, square, subsquare, and the TGL (Trimble Grid Locator): CM 87 XI 42 LF, which corresponds to latitude/longitude of 37 degrees 20 minutes 33.0 seconds North/122 degrees 2 minutes 46.8 seconds West.

Many hams find themselves involved with search and rescue duties, whether through the Civil Air Patrol or other public service agencies. Using GPS for precise positioning, coverage of search areas is very accurate and efficient, leaving no area overlapped or uncovered. GPS receiver readings can be directly applied to maps, and map-plotted positions quickly located.

Where is GPS Going?

Although initially designed for military usage, the civilian world has discovered GPS. No doubt the system's user simplicity, accuracy, and reliability factors have accelerated its acceptance. It is safe to say that GPS will, at some point in the future, directly impact nearly everyone.

The military uses GPS for aviation, marine, and land navigation. Examples include: aircraft instrument landings and carrier landings, rendezvous such as inflight refueling, improved bombing accuracy and ballistic weapon delivery (smart bombs), close air support, reconnaissance and target location, enhanced site surveying and field artillery placement. Insertion and extraction missions may be carried out with extreme accuracy (with safe and timely deployment and evacuation of troops), including medi-vac.

GPS was used during Operation Desert Storm for land navigation in the desert areas where maps of the deserts were virtually non-existent and desert physical/geographical reference points were scarce.

Marine navigation becomes very simple using GPS and harbor navigation accuracy will be greatly improved over current methods. Waterway and other mapping becomes as simple as pushing a few memory buttons while over-flying or otherwise crossing an area. Later, memory examination allows maps to be drawn.

For civilian purposes, the applications for GPS appear to be without limit. More and more uses are being found all the time, including:

Replacement of the various radio-based aviation and marine navigation systems.

Creation of a differential GPS (DGPS) system to increase the positioning accuracy to about 10 meters (39 ft). DGPS only requires that a local positioning signal be added to the mix of calculations made by the GPS receiver.

An ambitious projected application for GPS is Intelligent Vehicle Highway System (IVHS) technology. IVHS is planned for limited use in the year 2000. Nearly a billion dollars has already been spent or allocated for its development and implementation. IVHS encompasses automated highways and computer-aided vehicle guidance.

Rail systems and trucking agencies are using GPS as the basis for traffic management and scheduling.

In the realm of public safety, GPS will assist in resource management, allowing dispatchers to accurately determine where police cars, fire trucks, and rescue equipment are located at any given time. Police dispatchers will know the exact position of every car available or in use and can send a unit to assist whenever necessary, possibly saving an officer's life. Fire departments and rescue squads can use computer-based maps and information giving locations of fire hydrants, water supplies, and directions of travel. Using differential GPS, it is possible to locate individual firefighters inside burning structures.

During natural disasters such as earthquakes or floods it will be easy to locate underground utility lines, boundary areas, and limits of affected areas.

GPS allows land survey and mapping to accuracies of two inches or less. Special techniques and equipment are used for accuracies of this level.

The locations given by a GPS receiver can be applied to maps, preventing hikers from becoming lost. Further, in the event of an emergency, hikers can transmit (via phone or radio) their exact locations.

Important GPS Uses

An expedition scaled the tallest mountain in North America, Mt. McKinley, in June 1989 to determine its exact height by use of GPS. The exact height was determined to be 20,306 feet, which is 14 feet below the 1954 trigonometric measurement (anyone for placing a repeater up there?). Other mountains measured using GPS include:

Mt. Fuji, tallest mountain in Japan, at 12,382 feet.

Mt. Logan, Canada's tallest peak, at 19,546 feet.

Mt. Everest, tallest in the world, at 29,022 ft.

GPS was used to accurately place the position of the *Titanic*. During the Great 1993 Flood of the upper Mississippi River Valley, GPS was used extensively to monitor areas covered with water. Similar advantage of the system was made during the Christmas European Floods of 1993.

GPS—the Global Positioning System—is in your future.

For an in-depth study of GPS, see the author's latest book, Aviator's Guide to GPS, *published by TAB-McGraw Hill; telephone: (800) 233 1128.*

GPS Maps and Charts

by Gordon West WB6NOA

Global positioning system (GPS) receivers display latitude and longitude on their LCD or CRT screens. They also show SOG (speed over ground), COG (course over ground), speed, and distance to pre-memorized event or waypoint markers.

The latitude and longitude numbers would lead to position accuracies of approximately 10 feet, but the last significant number regularly changes. Why the change? This is because your position is purposely being diluted by the Department of Defense GPS satellite system to a 100-meter radius of a circle. It's called "selective availability," and purposely denies pinpoint accuracy to civilian users in order to provide a safeguard to national defense.

This selective availability—also called signal dithering—can be all but eliminated by subscribing to commercial or government differential GPS signals. The differential signals correct the selective availability error factor from somewhere within a 300-foot circle down to within a 5-foot circle 95 percent of the time! For the ultimate in accuracy, you would subscribe to your local FM station subcarrier access (SCA) differential GPS signals along with a little black box that hooks into a differential-ready GPS receiver.

For mariners, the differential correction signals come in free of charge from the United States Coast Guard. These are received on the 300 kHz marine radio beacon band, and a DBR that simply plugs into most portable or fixed GPS sets for boating position accuracy of approximately 10 feet. The U.S. Coast Guard differential system covers all of the East Coast, all of the Gulf Coast, and stations are going in right now for the West Coast and Alaska. Canada also participates in the differential GPS program. Hams living within 100 miles of a participating U.S. Coast Guard beacon station should be able to pull in these low-frequency signals, modulated MSK (minimum shift keying), with the right commercial equipment. No monthly user fee!

But latitude and longitude coordinates may not mean much to ham radio operators using GPS equipment for county-line calculations, hiking topo maps, or the common street atlases which rarely list latitude and longitude. Hams need something else, and they now have it!

One expensive solution is to tie a laptop computer into a GPS receiver with differential capabilities, and buy mapping software or maps on CD-ROM. If you have a computer, this is one option for you to consider.

If you need a portable mapping device, Sony is just coming out with their new Pyxis Model IPS-760 that uses micro C-Map cartridges, that are ordered directly from the supplier for approximately $129, covering several hundred square miles of area. These could be cruising charts, topo charts, street maps, or even the popular airplane charts.

Panasonic and Lowrance Electronics are also planning on hand-held GPS chart devices which will give you the cartographic data on a chart-like screen that covers a selected area of interest.

Trimble Navigation (Sunnyvale, California; 1/800/827-8000) combines the power of Thomas Bros. Maps and their hand-held Scout GPS, which converts the incoming signals to grid references in the map book. Or, for the VHF/UHF operator, the unit can actually read out which grid square you are in with *no* map book required!

"Our Scout offers a choice of nine coordinate displays: latitude and longitude in seconds or minutes; universal transverse Mercator map projection; ordinance survey of Great Britain; *Trimble Atlas* from Thomas Bros. Maps; Maidenhead grid locator system, including sub-square accuracy; Trimble grid locator—extension of Maidenhead for additional accuracy."

"With any of these readouts, our GPS equipment is ideal for the ham operator," comments Jim Osdale K6EUD, a local ham operator who teaches GPS navigation (714/779-5003).

Many ham operators have discovered a unique fixed-mount LCD screen GPS receiver from Lowrance, the Global Map 1000, as having the most built-in cartography for the buck. Boat GPS sets usually include an outline of the United States as part of the basic cartography built into the unit. For a close look at a local harbor, you would purchase $150 C-Map or Navionics cartridges, plug them into the GPS mapping unit, and presto, a vague outline of the U.S. will come into local harbor detail. C-Map is also working with Navionics to soon supply cartridges for selected lakes and rivers to cover those hot fishing spots.

But when Lowrance asked for a "canned" map of the United States to be burned into their firmware, little did they know what was going to be supplied—the United States with all major freeways and expressways built into the system without the need for any additional local marine chart cartridges.

"I don't go anywhere without my Lowrance GPS set in a rental car," comments Bill Alber WA6CAX, a traveling marketing consultant who has put away the map books for his new electronic readout. "When I am talking to someone who I will visit in a few weeks, I tell them I must have their latitude and longitude along with their office address. I enter this into the GPS charting device ahead of my trip, and presto, I see exactly where I'm going as I'm pulling out of the parking lot," adds Alber. "When it goes beep on arrival, I am usually within 100 feet of the front door," smiles Alber.

State outlines and many county lines are also included in the canned cartography. Same thing with rivers, too. And if you turn on your trail plotter, you can capture exactly where you have been, and see exactly the route you took. To demonstrate the accuracy of the plotter, see the *73* logo in Photo B.

All marine-type GPS sets are priced at the bottom end of the long list of equipment designed for commercial surveyors. A survey set might run $3,000, but you can buy a marine Garmln GPS-50 for under $400! The inexpensive marine sets also output NMEA 0183 data, and this ties into those $600 LCD chart display systems. Those marine sets also tie in nicely with APRS—automatic packet reporting system. This turns your GPS set into a position enunciator that squawks your location on packet! Not only can you see where you are, but other APRS systems can actually see where you're going on *their* system.

During a recent trip throughout the United States, I found that the GPS antenna/receiver unit worked nicely in the back window of rental cars. Only now and then did the reception drop out when I was in between tall buildings in Miami and Los Angeles.

Marine GPS prices won't dip much below $400, so check out what is available down at the marine stores, and tune into 1575 MHz and get set for hand-held and mobile position finding.

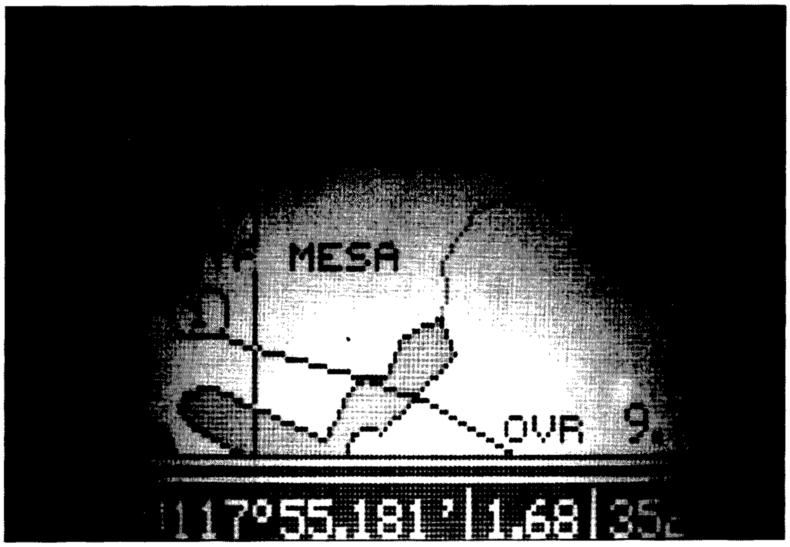


Photo B. The trail plotter feature allows you to display exactly where you've been—in this case, on the 73 trail!

World's Smallest 10 GHz ATV Transmitter

Build one on a PCB using only a few components!

by Angel Vilaseca HB9SLV and Jean-Pierre Morel HB9RKR

The availability of cheap surplus GaAsFETs lately has made a lot of microwave experimenting possible for amateurs. This article describes a new kind of amateur 10 GHz low-power transmitter using a surplus GaAsFET, mounted on a tiny piece of Teflon/glass PCB. Wideband FM modulation is possible for ATV operation.

As microwave-oriented amateurs, we (the authors) began experimenting back in the '80s, using Gunn diodes in waveguide assemblies. These, provided they were home-built, using cheap surplus diodes, were very cost-effective when compared with commercial transceivers (e.g. the Gunnplexer). The main disadvantage was the "plumbing." It took a lot of time and a fairly well-tooled workbench to build waveguide-based designs. For instance, some parts, like the screws used to hold the diodes, could only be made with a lathe.

However, if you were ever drawn away from the 10 GHz band by the mechanical difficulties, this article is for you. The 10 GHz transmitter we are describing could hardly be simpler.

The GaAsFET Oscillator

Trying to design a GaAsFET oscillator with PUFF, a computer program previously described in this magazine, we first considered a design like the one in Figure 1.

Like in many oscillators, the oscillation takes place if there is an adequate feedback from an amplifier's output to its input. In the oscillator shown in Figure 1, the feedback is provided by the two close-coupled stubs connected to the gate and drain microstriplines. The source terminals are connected to the ground plane.

Making the Oscillator Radiate

Any conducting patch etched on a PCB radiates a part of the energy it is fed with. If the dimensions of the patch are small in terms of wavelength, little energy is radiated. As the patch dimensions increase, radiation increases too, until a λ/2 patch dimension is

Continued on page 18

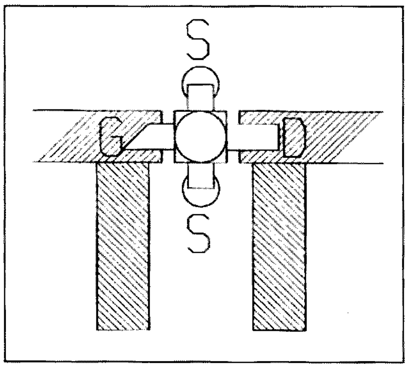


Figure 1. A GaAsFET oscillator. G, D, and S = gate, drain, and source respectively.

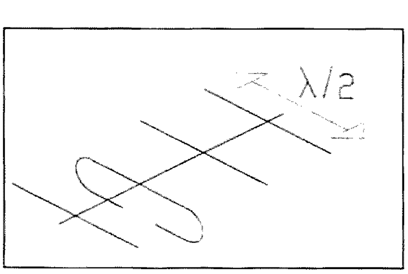


Figure 2. In a yagi antenna, the elements are about a half-wavelength long.

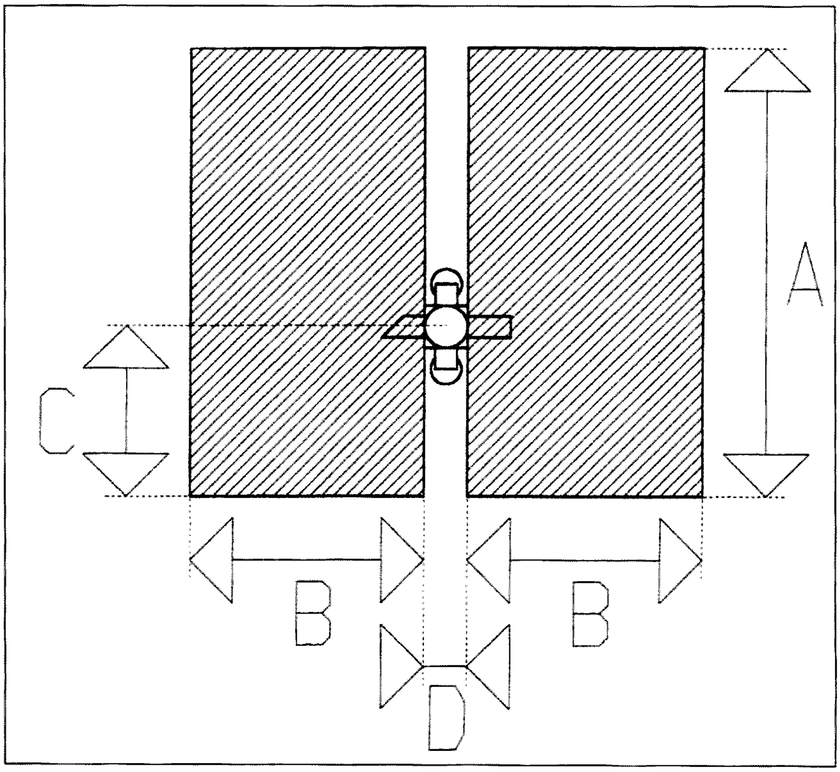


Figure 3. The oscillator circuit dimensions. (See text.)

World's Smallest 10 GHZ ATV Transmitter

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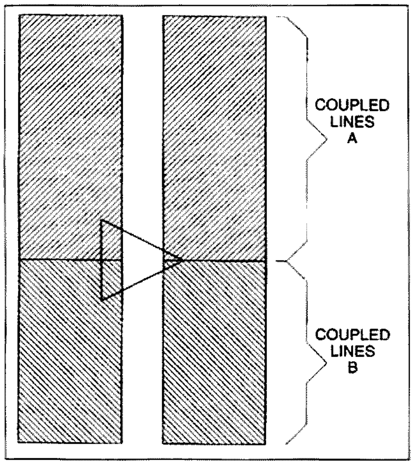


Figure 4. For PUFF, the oscillator is an amplifier with two pairs of coupled lines connected end-to-end. Various A and B lengths were tried, with the overall length A + B remaining λ/2.

reached. This is when radiation efficiency is at its best.

This principle is not new to us: Yagi antenna elements are also about λ/2 long (Figure 2) and they are particularly efficient when it comes to radiating energy from our transmitters! Radiation from microstrip elements is used in so-called *microstrip antennas*.

What we tried to do here was to combine the design of the previously mentioned oscillator with a microstrip antenna. Two microstrip antenna patches were designed close-coupled to each other. The GaAsFET input (gate) was connected to one, and the output (drain) to the other, thus obtaining the following design (Figure 3).

We decided to make both patches with the same dimensions for our first try. In fact, this is questionable, because if the two patches radiate with opposite phases, then their respective radiations would cancel each other!

Perhaps a more in-depth theoretical (and mathematical) approach would be needed here.

However, experimentation showed that some radiation did take place. In fact, some mutual cancellation from the two patches can be desirable if it is thought of as equivalent to limiting the output coupling of a conventional oscillator. If all possible energy is coupled out of an oscillator, its stability will be bad, because its characteristics will be affected by the circuit it is coupled to.

Designing the PCB

Now, there are four dimensions, A, B, C and D (Figure 3) we must decide.

We described the circuit to PUFF in the

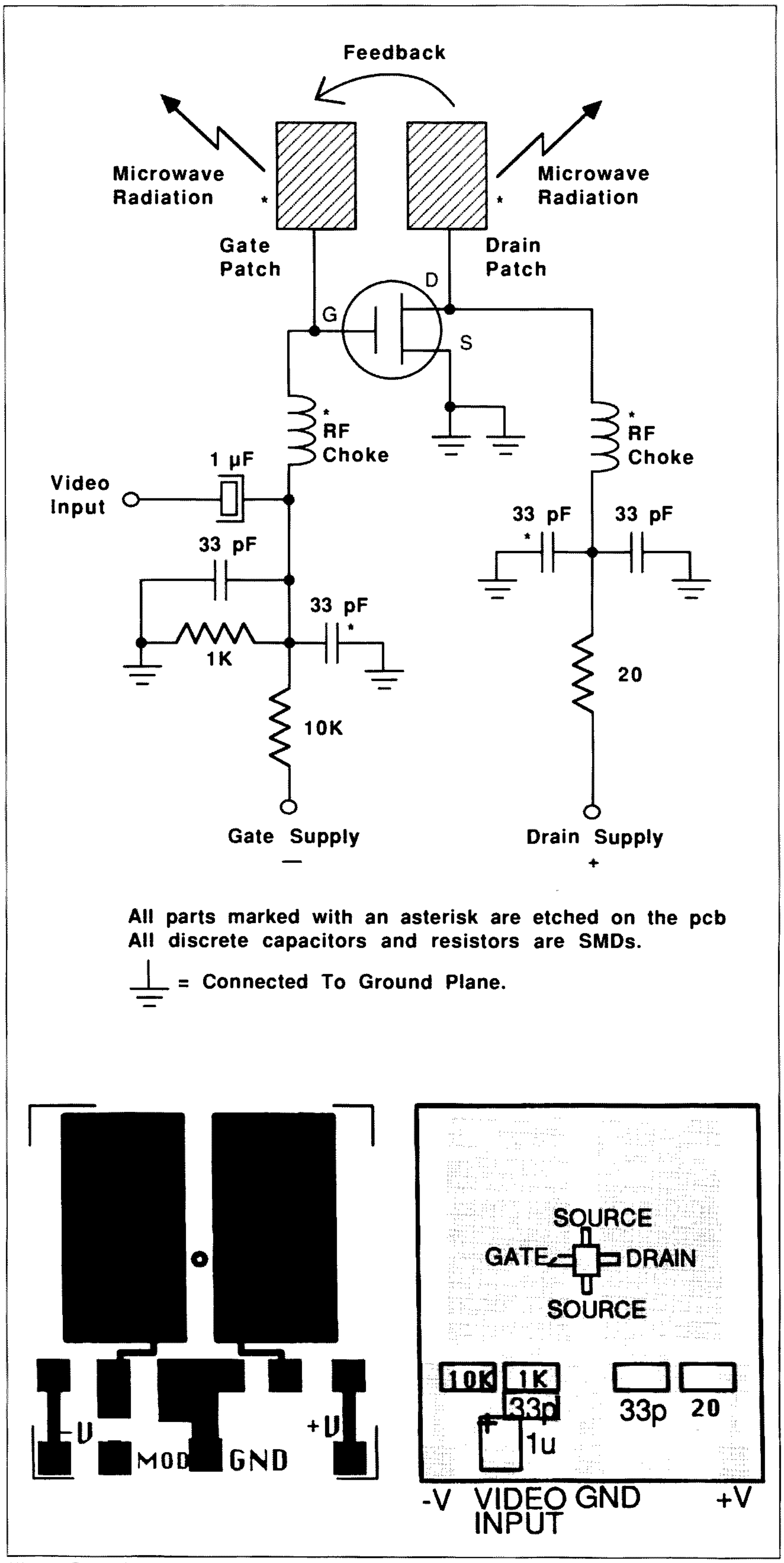


Figure 5. a) Circuit schematic. b) A drilled and etched double-sided PC board for this project is available for $5 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

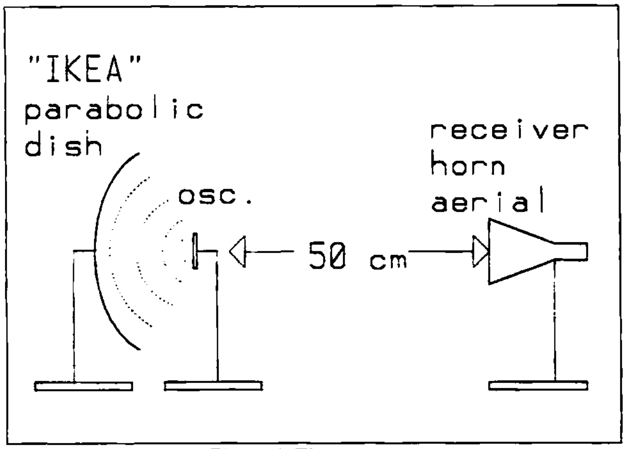


Figure 6. The test setup.

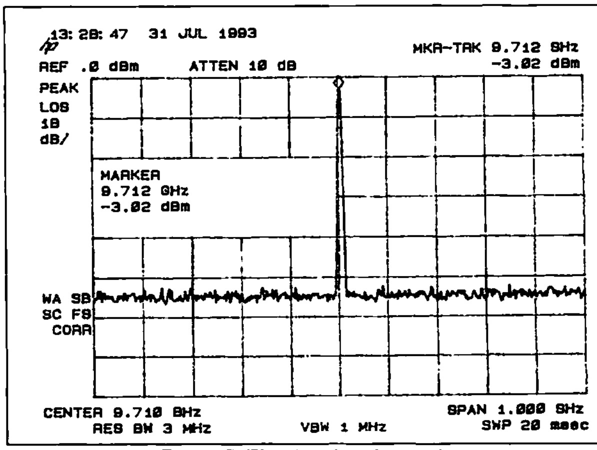


Figure 7. The signal at the receiver.

following way (Figure 4):

First, the coupled lines A and B were chosen with the same low impedance. Low impedance means that they are broad, like a microstrip antenna patch. Dimension B+D+B should be equivalent to about a half wavelength to maximize radiation.

Second, to generate enough feedback for oscillation to occur, they were chosen with tight coupling, which means close to each other. This determines dimension D.

Third, the overall electrical length of both lines put end to end (A) was chosen at about $\lambda/2$ to maximize radiation. The point at which the GaAsFET was attached to the two patches (dimension C) was searched with PUFF, by trial and error, so that S_{12} feedback was as high as possible.

Finally, we decided to start experimenting with the PCB pattern shown in Figure 5.

As an aerial we used an aluminum parabolic reflector, an "IKEA" dish, sold as a lamp, available cheaply in furniture shops. *[Editor's note: The authors' QTH is Switzerland. You may have to improvise if you cannot find the IKEA lamp locally.]* The diameter of this lamp dish is 40cm and its focal length is rather short, at about 11cm. So F/D is low, at 0.27. The oscillator was simply put at the focal point, so it would illuminate the dish . . . no more "penny feed." How is this for simplicity? (Figure 6).

The GaAsFET we used was a "Red Spot" from Birkett, 25, The Strait, Lincoln LN2 1JF, UK.

Dimensions D and B (Figure 3) were held constant throughout the tests: D = 0.5mm, B = 10mm.

Testing

For our first test, we took A = 18mm and C = 6.5mm. With +V supply = 4 V and -V supply = -3.5 V, Id was 23.4 mA and we received a -3 dBm signal with our horn antenna.

Oscillation frequency was lower than predicted at 9.712 GHz (Figure 7). The received signal was best with the oscillator being shifted away from the focal point, at 16.2cm instead of 11cm. This probably means that the radiation angle from the PCB is too narrow to illuminate the whole dish evenly (Figure 8).

Eventually, the GaAsFET failed (it did draw quite a lot of current) and was replaced by a first-class, expensive CFY 18-23 from Siemens. A was left unchanged at 18mm and C was tried at 7mm. The received signal was much lower, at -17.3 dBm. With C = 8.5, the oscillations stopped.

Most interesting was the fact that this small change in C brought the frequency almost 1 GHz higher at 10.653 GHz.

We replaced the CFY 18-23 with a new red-spot GaAsFET, with C left at 7mm and the frequency remained the same, so it really seems that the frequency shift comes from the C modification, rather than the GaAsFET change.

To lower the frequency down into the amateur band, we fitted two small pieces of copper foil to the ends of both patches, increasing the A dimension to 19mm. This brought the frequency to 10.293 GHz. +V supply was + 3.5V; -V supply was -4V; Id = 16.5 mA.

Figure 9 shows the received signal when the oscillator is frequency-modulated by sending a 4.5 MHz sinusoid to the gate. Linearity is acceptable.

Modifying the power supply voltage did not change the drain current much. Frequency did change but not linearly.

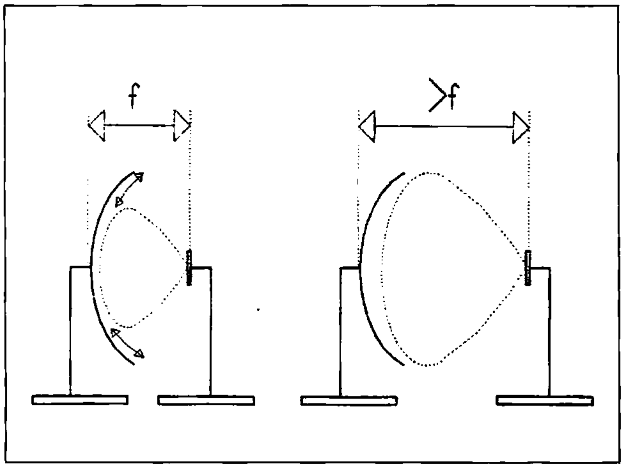


Figure 8. If the oscillator is placed further from the parabola than the focal length, it illuminates the dish more evenly.

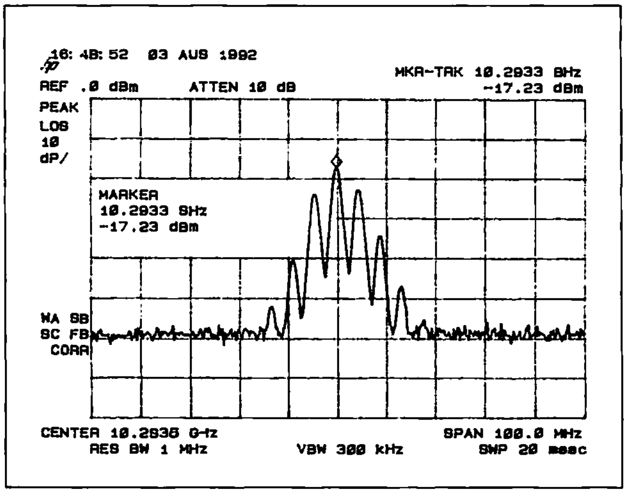


Figure 9. Output signal when the oscillator is frequency modulated.

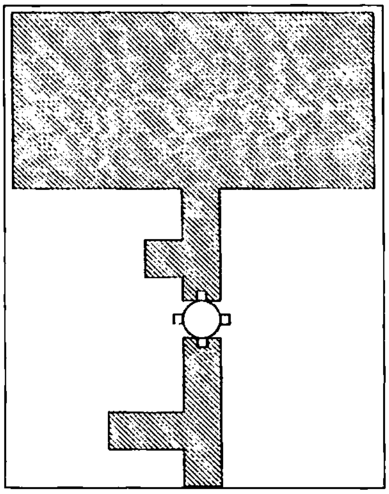


Figure 10. A preamplifier connected to a microstrip antenna.

+V Supply	-V Supply	ID	Frequency
+3.0V	-4V	15.5 mA	10.363 GHz
+3.5V	-4V	16.5 mA	10.354 GHz
+4.0V	-4V	17.5 mA	10.376 GHz

The received signal was best at -17.23 dBm when the PCB was set at 13.5cm from the dish. The cross-polarization attenuation was rather high, with a maximum of 30 dB.

The total radiated power was estimated at about 1 mW: Replacing the circuit under test with a Gunn transmitter of 1 mW known power output gave the same signal on our test bench.

We tried to further decrease C to 5mm. this sent the output power up about 3 dB and the drain current down to 11.4 mA. Oscillation frequency went down to 10.180 GHz, which allowed us to remove the two pieces of copper foil we had fitted to the patches' ends. This brought the frequency back up to 10.430 GHz.

We then discovered that the circuit was radiating both on 10 GHz and 5 GHz! We had not noticed this at first because the short length of waveguide between the horn antenna and the receiver was acting as a high-pass filter; (cutoff frequency of 1" X 1/2" waveguide is about 6.5 GHz). Further shortening the patches cured the problem.

Conclusion and Further Developments

Well, this is it: We have made a seven-component 10 GHz ATV transmitter, possibly a *Guinness Book* record! Stability was good, with little frequency shifts caused by moving objects near the TX. Although we did not try it, temperature stability could probably be enhanced by enclosing the transmitter between two plates of expanded polystyrene. This material has very small losses at 10 GHz. Another improvement could be fitting a dielectric stabilizer to the oscillator.

Simplicity is not the only advantage of building a transmitter of this kind. Having the 10 GHz source directly at the parabola's focus also avoids losses in waveguides, coaxial lines, transitions, relays and so on.

This would be particularly interesting in a receiver. The preamplifier could be built directly at the parabola's focus, the dish being illuminated by a small microstrip antenna attached next to the preamp (Figure 10).

As we know, any loss between the antenna and the preamp severely affects the receiver's noise factor. An assembly like the one shown in Figure 11b should be much less lossy than, say, the one in Figure 11a, and much cheaper, too, when you consider the price of an SMA connector or a microwave T/R relay.

One last word of caution: As for all GaAsFETs, it is highly advisable to turn on the negative gate supply slightly *before* the drain supply, because this keeps the drain current at a safe level. If the gate is left at ground voltage, a large current surge at turn-on could blow the GaAsFET. Microwave semiconductor chips are really tiny devices so their power safety margin is quite small.

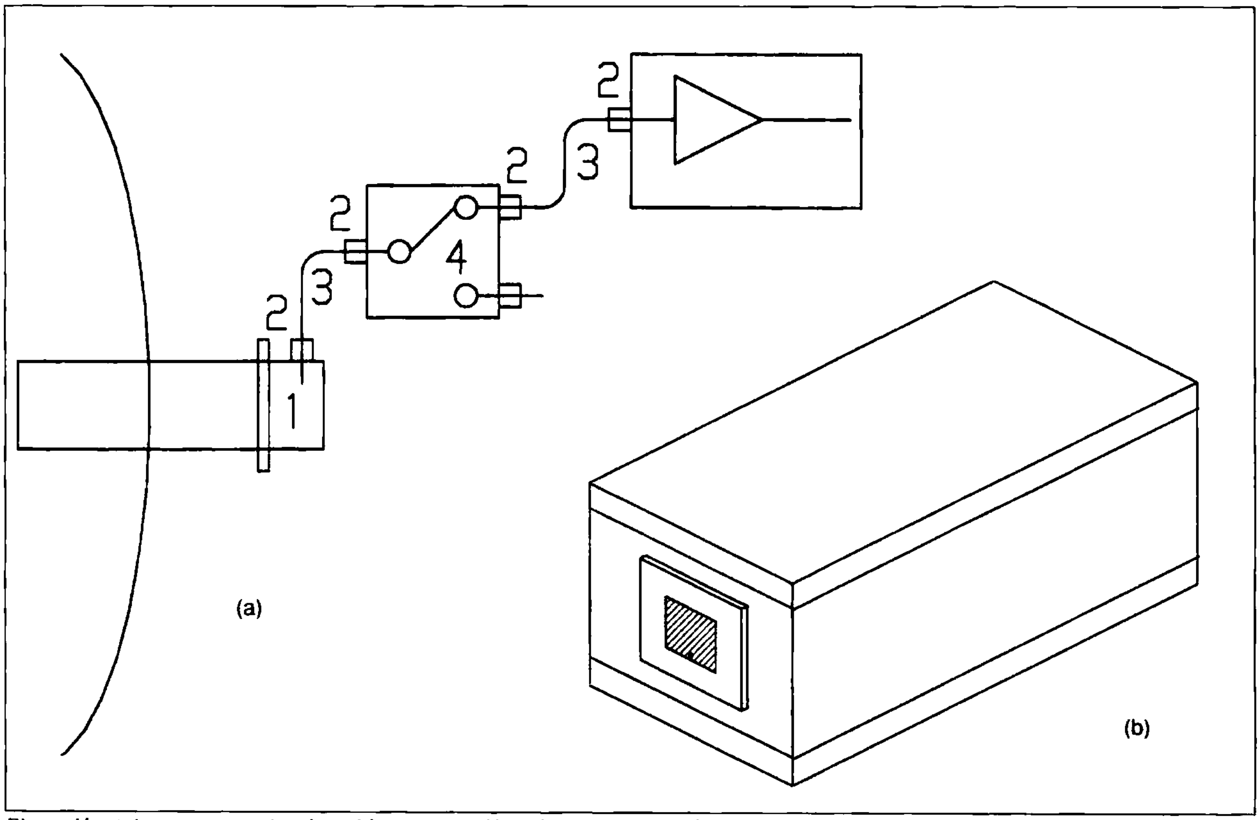


Figure 11. a) A more conventional (and lossy) setup. Note the 1) waveguide losses, 2) connector losses, 3) coax losses, and 4) relay losses. b) The preamp can be enclosed in its shielding box with a small microstrip element glued on the outside. The assembly is placed in front of the parabola with the microstrip patch at the focus.

EMI/RFI Defense Strategies for Hams

Keep those troublemaking signals out of your mobile installation!

by Donald Koehler N7MGT

You just finished the installation of a brand-new VHF (or UHF) FM rig in the car. You turn it on and get a good VSWR and signal check. After cleaning up, your significant other asks for a ride to the mall on the other side of town. You start the car and fire up the rig. Squelch needs adjusting? You crank it up and drive off. Repeater traffic light? Friends complain you don't answer calls? You may be the victim of RFI/EMI.

What is RFI/EMI? Radio Frequency Interference, also known as Electromagnetic Incompatibility, is when one (or more) electronic or electrical device affects or disrupts the normal operation of a "victim" system. In the example above, the new radio was victimized by weak, wideband noise from digital automobile systems. This problem is often exhibited by "lost" calls or high squelch settings.

This article will cover EMI/RFI defense strategies, installation practices, and hazards which may result from using certain EMI/RFI cures. Let's start by examining three broad areas of action which can help resolve EMI.

In the broadest sense, EMI can be combated by *avoidance, attenuation* and/or *isolation*. Any of these, or some combination of the three, may be necessary to eliminate EMI problems with installed equipment.

Avoidance

The least expensive of these strategies may well be avoidance. Avoidance covers several areas:

- •Pre-installation checks of the area.
- •Use of commercial software to find harmonic "hits."
- •Use of service bulletins.
- •Power levels appropriate for intended communications.

Each one of these options offers some advantage for the ham or other installer. While not listed in any particular order of importance, these areas should be the first you turn to in installation planning and practice.

The use of a broadband, high-speed scanner can go a long way toward identifying potential EMI sources after a problem arises. Use of the scanner prior to an installation can save time, money and possibly missed emergency traffic. How do you use the scanner in a pre-installation check?

I suggest using scanners in two ways. First, load all of the common channel frequencies you intend to use into the scanner. Then, with the vehicle operating normally (assuming a mobile installation), let the scanner run. Listen for "hits" or EMI on these loaded channels. The hit may sound like static, a whistle or a rough buzz. Open the hood, then carefully work the antenna near the battery and any of the installed "black boxes" (fuel injection computers, etc.). Do the same on the inside of the vehicle. Run the heater or other accessories at this time.

If no noise source appears, switch the scanner to the search mode and set the search limits to just above and below the range of frequencies desired for use in the installed equipment. Most modern scanners, such as the ICOM miniature series and AOR handhelds, cover 100 kHz to 2.0 GHz. They are more than useful for this check. Note the frequencies where the hits occur and see if they are on, or are harmonically related to, planned frequencies. More on this in the "Installation Practices" section.

The use of commercial software to run checks on installed or contemplated frequencies may save a lot of grief up front. Harmonic relationships may be hard to discern, but the problems which crop up are real indeed. Most commercial software is powerful enough to keep you out of trouble. Take a minute to run these checks before installing new equipment into systems or vehicles where communications equipment is already in use.

If you can take a few moments to look through equipment service bulletins prior to installation, you may save time. Look for warnings on minimum equipment clearances, grounding and power requirements, antenna or power cabling restrictions and other information which may impact on the planned installation. Finally, use the least amount of power necessary for the job. Modern radio sets have computer-controlled-and-set wideband frequency and power settings. Never use more power than is called for in the installation package. Besides being bad practice, it can cause EMI or desense in

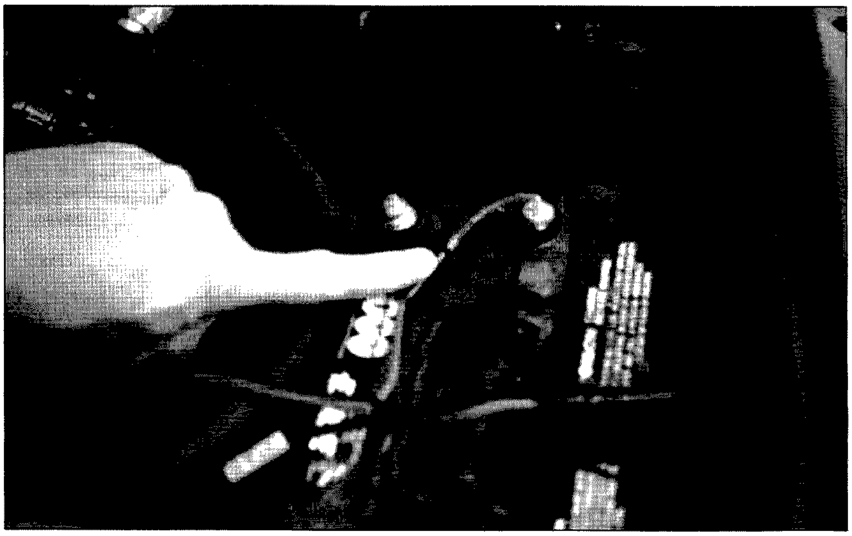


Photo A. Don't leave power wires running unsecured across the engine compartment! Poor installation practices often lead to EMI/RFI problems.

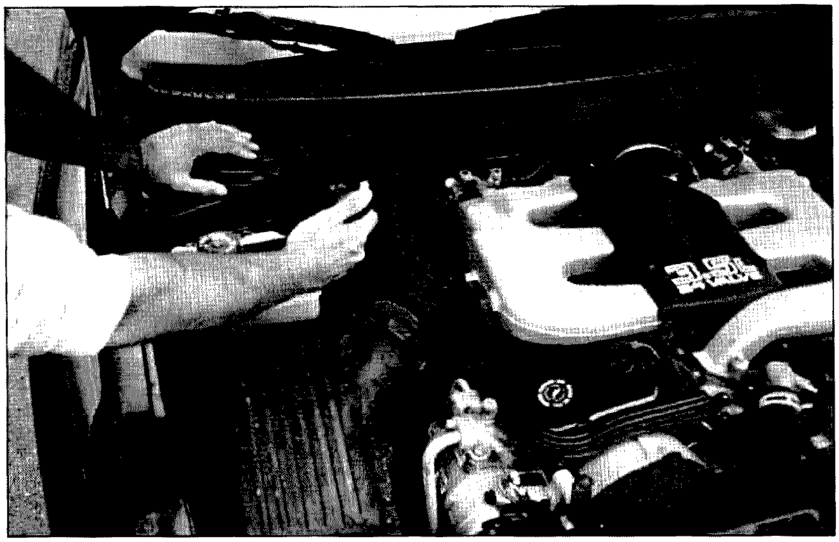


Photo B. Using a scanner will help pinpoint problem "black boxes."

other installed equipment. In this case, the old saying "if a little is good, gobs is great" doesn't hold true.

Attenuation

The issue of power output brings us to the next of the major strategies, attenuation. When EMI problems arise, one of the main efforts taken by experienced technicians is to attenuate the interfering signal. This attenuation may take many forms. The most typical is using filters, both RF and IF. You may not normally consider cavity filters, crystal filters and alternate siting of antennas to be a form of attenuation—but that's what they do to the unwanted signal. One filter strategy often overlooked is using ferrite beads on power leads and, occasionally, on RF cables. Finally, bypass capacitors on power leads or power sources offer a low impedance path to ground for EMI signals.

Isolation

The third strategy is isolation. By the use of shielding, bonding, and AC or DC filtering, the communication equipment can be isolated from EMI signals. The shielding may take the form of conductive foils, tubes made of conductive or attenuating material, conductive caulks and conductive tapes. When using these conductive shields, extreme care must be taken to ensure the material will not come loose and short out other equipment. The idea of the shielding is to conduct the EMI signal away from your equipment and to provide a low impedance path to ground. Another way to do this is to ensure that all equipment is properly bonded to ground. New vehicles make extensive use of plastics and exposed metal that often have been coated with anti-rust compounds.

Bonding can take several different forms. Use of conductive strapping, tying together both radio equipment and mounts to the vehicle frame, is a good, low-cost start. Further work to tie the vehicle body, frame and negative battery terminals into one circuit may yield results to reduce background noise. When running power leads, make the run as

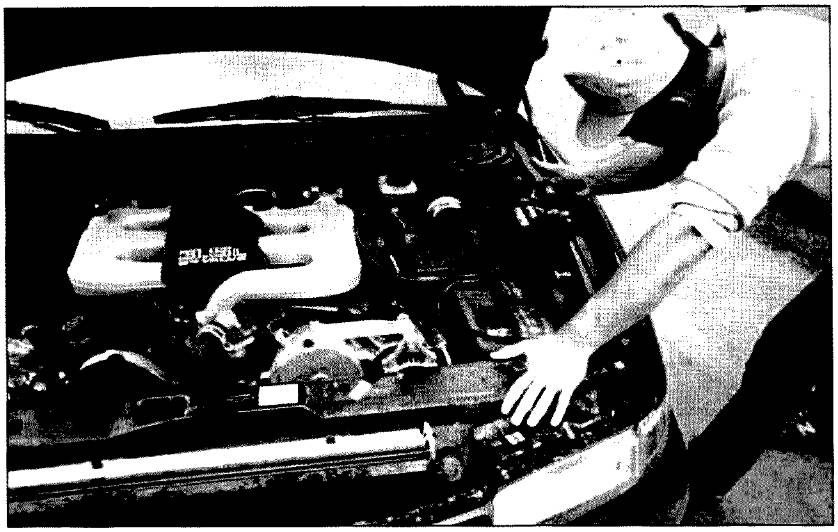


Photo C. Using a scanner to determine the best route for power leads saves time and trouble.

short as possible using proper gauge wire. AC and DC filters such as chokes and capacitors will help to keep "hash" or wideband noise out of equipment. I have had luck with additional filtering gained from ferrite beads placed over the power leads. Secure these ferrite beads with glue or tie-wraps to avoid damage to the bead caused by movement. Now let's tie this information into the installation process.

Installation Practices

When first planning the installation of communications equipment in a vehicle, take a moment to "sweep" the area with a scanner. This should show potential EMI sources. Typical areas are near vehicle black boxes, digital dashes and other displays with multiplex drivers. Once any EMI sources are identified, route power and RF cables away from the source. If the cable routing doesn't allow for avoidance, the use of shielding may be required.

Flexible, conductive tapes, conductive caulks or foils can be used to cover the cabling which runs by the source. Short lengths of cable requiring this EMI cover can be easily fabricated in the field. Grounding of this cover material is usually not necessary. Each application will be unique, though. Common-sense precautions are essential when using conductive materials around power sources. Covering conductive materials with insulating tape will not impair the shielding properties of the material.

Taking the time to bond the radio, the mount and the vehicle body together can eliminate sources of wideband noise. When installing mobile computing equipment, this step may become even more important as this equipment can often generate large amounts of wideband digital noise. Use care to bond the interconnecting cables and connectors. Ensure solid ground paths on the vehicle by sanding the area around the connecting fastener. The use of modern anti-rust compounds can impair or raise the impedance of the ground path. To protect the ground connection and fastener, the use of conductive caulks or grease is recommended. Use of small amounts of conductive caulks under mount "fingers" may improve grounding of blind mount antennas when installing equipment in off-road vehicles or in humid climates.

As always, when installing equipment in off-road vehicles, take the time to read both equipment and vehicle technical data. I have had good luck with these rule-of-thumb procedures when installing radio equipment in vehicles as diverse as aircraft fueling trucks, snowplows, forklifts and fire trucks. If you have questions, talk to your vehicle service personnel or dealer.

Avoiding Hazards

Even the best-planned installation can generate hazardous conditions. Let's look at some of those conditions.

When using conductive materials for attenuation or shielding, be careful! These materials may become conductors of opportunity or part of sneak circuits not protected by fuses. To guard against this hazard, I fuse both positive and negative power leads as close to the battery as possible. Foils used for shielding can cause heat buildup. Before using foil as shielding material, ensure that doing so will not violate the vehicle's warranty. After installation, check all vehicle systems with the installed equipment up and transmitting. Imagine how embarrassing (and dangerous) it could be if your transmitter caused the vehicle anti-locking brake or fuel injection system to fail. While these types of problems are rare, it only takes a moment to check EMI interactions with the vehicle's systems after the installation is complete.

After all, if you didn't install the vehicle alarm, cellular phone or stereo equipment, you must be sure that these common systems don't cause problems for your new mobile rig. Take the time to use some of these strategies, and enjoy your EMI-free mobile operations. 73

Installation Hints

Good installation practices will go a long way toward preventing possible EMI problems. Try these tricks—they work well for commercial and amateur installations:

•Replace the battery terminal clamp with a new, tight-fitting clamp. Use the kind with a new "generator" lead cast into the clamp. Pull the DC buss line power from this clamp.

•Use a multiconnect or "barrier" block for your DC buss. This makes it easier to place by-pass capacitors, if necessary.

•Don't splice wires, if at all possible. Each joint is a possible corrosion spot that could cause problems.

•Don't install the radio next to or under heater vents or, on older cars, near the heater or wiper motors.

73 Review

Number 7 on your Feedback card

by Michael Bryce WB8VGE

S & S Engineering
14102 Brown Rd.
Smithsburg MD 21783
Telephone: (301) 416-0661;
Fax: (301) 416-0963
Price Class: Kit—$49.95;
Assembled and tested—$69.95;
4-digit add-on kit—$16.95.

S & S Engineering's Frequency Counter Kit

Now you can count frequencies 'til your heart's content.

When S & S Engineering sent me this frequency counter kit for review, gosh, did it bring back memories. My first home-brew frequency counter came to life in the mid-'70s. Oh, those were the days! Johnny Carson was king of late-night TV, the Bay City Rollers were rocking Top 40 radio, and the USSR and the USA were sneering at each other. All you needed for a frequency counter back then was a VW bus full of TTL logic chips, 15 pounds of solder, yards of multicolored wire and several PC boards to hold everything together. Any ol' 5 volt supply at 27 amps was all it took to fire her up. On a good day, with the wind blowing just right, you might be able to read 10 MHz. Provided you handpicked the first gate chip, a 74HS90.

The S & S Engineering Counter Kit

We've come a long way since my first home-brew frequency counter. S & S Engineering now has available a frequency counter kit for under $50 bucks. Even on its worst day, its top end is 75 MHz. Why, with the exception of two wires for the battery, everything is on one PC board. Best of all, the entire counter can be run by a single 9 volt battery.

The display is a large 1" LCD giving you four-digit resolution. This can be expanded to eight digits later if you wish. The upgrade is simple, easy and, most of all, cheap—less than $20. I highly recommend you get the upgrade to eight digits.

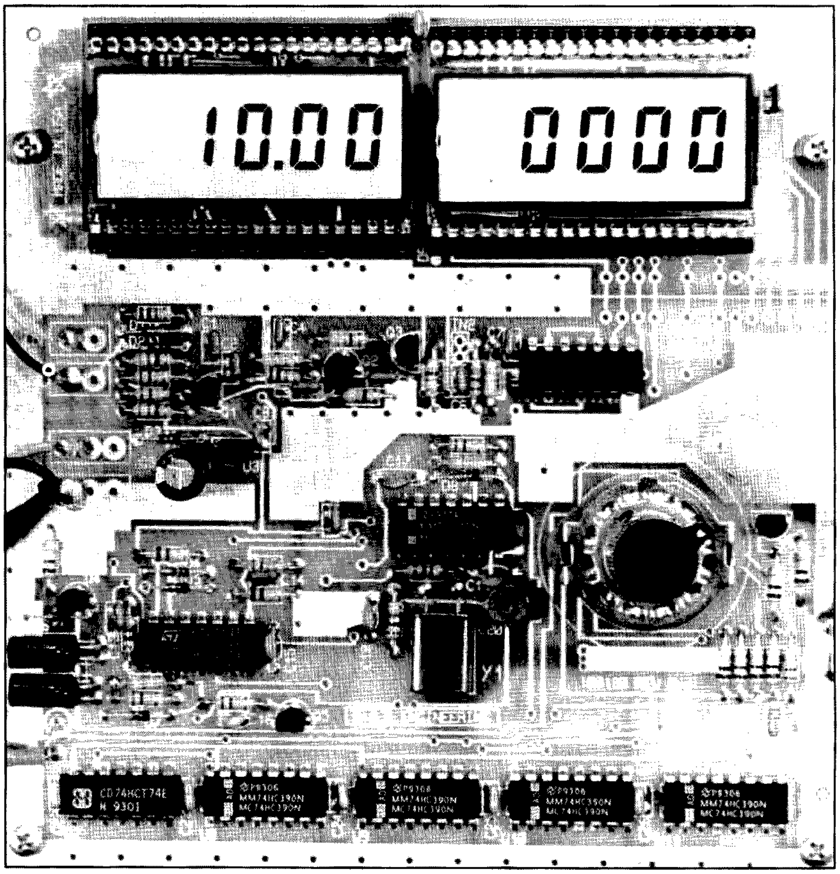
The S & S Engineering counter kit consists of a high quality double-sided PC board with plated-through holes. The PC board has the parts layout silk-screened on it, and it has been laid out so the top third of the board, the portion holding the LCDs, can be cut from the logic section. This way, you can mount the display away from the logic section for a custom installation. There are only 12 wires needed between the display and logic. Ribbon cable would be ideal for this. I did not separate the two for this review.

The kit does not come with a cabinet; that part is left up to the builder. There are four metal standoffs supplied to raise the PC board up. This way, you can leave it as is and just use the bare circuit without a box.

As with all of the S & S Engineering kits, the part quality is first-rate. No "hamfest special" parts or surplus goodies are in this kit. As complex as a frequency counter is, most of the work is done by specialized chips. This reduces the overall part count of the kit to just a handful of IC chips. All the ICs come in static-protective packaging. The kit includes everything you need, including a 9 volt battery snap. Sorry, the battery is not included.

Assembly

Assembly is very straightforward: You start with the resistors, move on to the capacitors, and finish up with the transistors. The ICs are installed next. Although IC sockets are not provided with the kit, you should use them. The IC sockets are cheap insurance in case you solder a chip in backwards or install the wrong chip in the right hole. Unsoldering an IC from a double-sided PC board with plated-through holes is not for the weak-at-heart. The kit requires six 14-pin sockets and one 16-pin socket. There is one 40-pin chip under the LCD display that you can't use a socket on. It would make the chip too tall, and make it impossible to mount the LCDs on the board.



As with most counters, you can select the gate time of the counter. You can select between 10k, 1k, 100, 10, or 1 Hertz resolution. A multi-pole rotary switch mounted directly on the PC board selects the gate time. There are no interconnecting wires to worry about. But, this switch might prove a pain in the butt if you want to mount the logic board separate from the display. Some forward-thinking would be in order before applying solder to the switch terminals.

Assembly went along without a hint of trouble. The instructions are a bit thin, but they get the job done. All in all, it took me about two hours of work to complete the kit, even with extra-long breaks for Oreo cookies and Diet Coke. I installed the extra LCD and its driver chip, too.

Testing the counter is about as simple as you can get. Apply power, and connect the input of the counter to a test point on the PC board. If everything went in as it should, you'll see 10 MHz on the display. A trimmer capacitor on the PC board calibrates the counter to either WWV or a known 10 MHz standard.

Operation

The counter will operate on a fresh 9 volt battery for several hours. There is no power switch. For use on your workbench, just about any quality source of power will work. Watch out for those wall-wart power supplies! Many are nothing more than one diode with very little filtering. The input supply voltage is between 7 and 15 volts DC. The counter requires about 50-60 mA.

Set the rotary switch to select the gate time and thus the amount of resolution you require. The longer the gate time, the better the resolution of the frequency displayed. The longest gate time is about four seconds to update the display. That's it!

Since the S & S Engineering kit is so self-contained, it opens up a new way of seeing things. I've always used a frequency counter to spot trouble. They make great *sniffers* of RF. The S & S Engineering kit has more than enough sensitivity to sniff out weak signals. In fact, it could read the test point just by holding a wire near the input pin.

I found a particularly useful task for the frequency counter: Reading the VFO of a direct conversion transceiver. You can also use the counter to display your operating frequency in a superhet receiver, too. In fact, there are some suggestions on how this may be accomplished in the assembly manual. Since you don't require the longer gate times, and thus the four extra displays, the standard four-digit unit works best. I would bypass the gate switch with jumper wires. By using this counter, you can add an LCD frequency counter to your latest home-brew project.

The Last Page

This project is simple enough for a beginner to handle. It would be best if you have some idea of how to solder, what end of a diode is what and, of course, the proper installation of IC chips. Except for the calibration adjustment, there's nothing to touch. If you assemble it correctly, it's going to work.

Johnny Carson has retired, the USSR is no more, and you don't need a 700 watt switching power supply to operate this frequency counter. Best of all, you don't need a VW bus to carry it in. The S & S Engineering frequency counter kit is an excellent value. It's easy to build, easy to operate, and has all kinds of possibilities in your ham shack.

73 Review

Number 8 on your Feedback card

by Breckinridge S. Smith K4CHE

The LDG Electronics FC-1

LDG Electronics
1445 Parran Road
St. Leonard MD 20685
Telephone: (410) 586-2177
Price Class: $69.95 plus S&H

A small, flexible fox controller and CW IDer.

If you are a serious foxhunter, you have probably tried putting together your own "foxbox" with timers, identifiers, etc. You have tried the different circuits using timing capacitor networks and different chips, and you have probably soldered in those countless diodes in that matrix for the IDer. Recently I tested the LDG Electronics Microprocessor Fox Hunt Controller/CW IDer board. This small Maryland-based company has developed a real gem. Yes, the East Coast does produce some foxhunt goodies.

Why do you need a microprocessor controlling your hidden transmitter? What I wanted was a timer/IDer system that was small, reliable, and easy to change. I wanted to spend more time on my own DF equipment, helping beginners, and not spend hours building and testing numerous timing circuits. I wanted to be able to change the identification and timing cycles of the hidden transmitter to suit each individual hunt. I am not an avid computer enthusiast but the LDG ad in *73* said I could program this controller from my PC so I gave up and ordered the board. Time to join the microprocessor crowd.

The Board

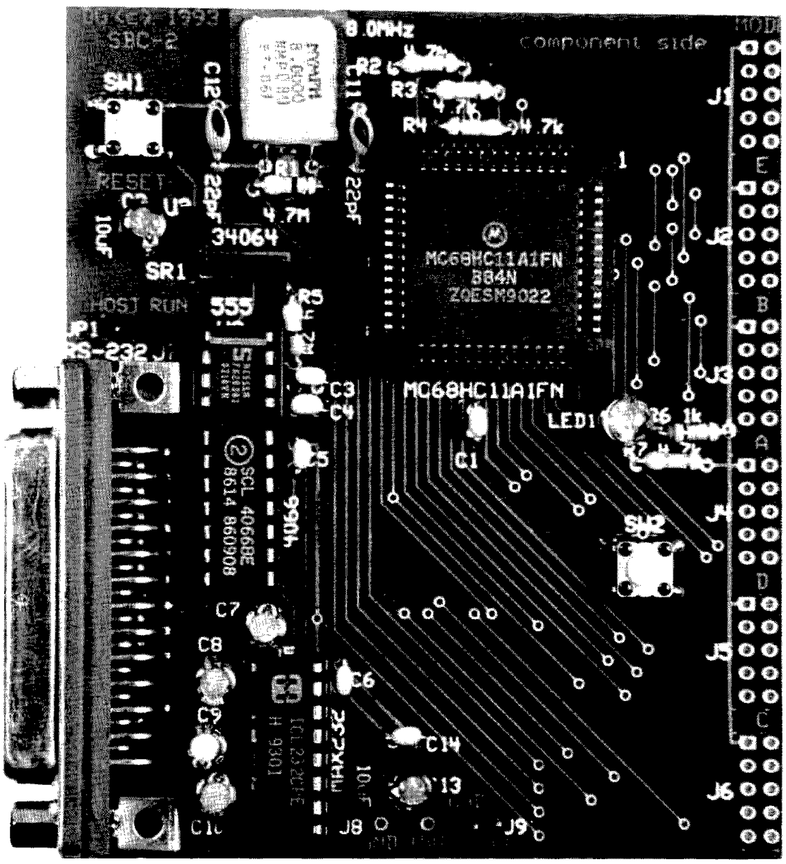
What I got was a small assembled 3.1" by 3.6" board that was not a kit; a board with professional printed circuit traces and a small plug-in module for the audio, keying, and power functions. Included in the package was over 450 pages of documentation contained in four separate handout/books, and a floppy disk with numerous programming files on it. After wading through the information I found the three-page fox controller sheet and the 24-page LDG manual.

Reviewing the documentation, I realized that what I had received in the mail was a foxbox controller and a small single-board computer/processor using the 68HC11 microprocessor. I know that there are more advanced microprocessors out there but, again, you have to start somewhere. You can use the system as a foxbox controller/CW Ider, or do your own experiments with the microprocessor using the 450 pages of documentation. LDG also markets this same basic board as a 16-output DTMF decoder which requires different software and a different plug-in module.

Programming

The controller arrived with a test program loaded. I recommend you test the board initially to get familiar with the different push-buttons and board operations, then proceed with your programming. You load the LDG disk program using their disk into your computer and then you modify the FOXMCW file to suit your identification and timing requirements. Their handout tells you which lines on the files to modify. Using an ASCII file edit program, you may change values on selected lines by typing in different number values for timing, tones, speeds, and real letters for the modulated CW identification. You then "reassemble" your changes using the assembly program which is on the supplied disk. After you assemble the program you can then send to the LDG controller via RS-232 cable.

I told you I wasn't a computer person! The loading program is written In BASIC; I spent 20 minutes trying to type in the command "BASICA Bootload" instead of "GWBASIC," which is what I had installed on my computer. I would have preferred a more detailed step-by-step instruction sheet of the programming



process, but the instructions supplied are adequate . . . if I can do it, you can do it.

During your programming you may modify the initial delay time prior to startup, the first and second identification messages, and the on and off periods that will be repeated during the hunt. LDG included a second identification message feature which is unique: You can have a push-button on your foxbox wired to the LDG controller's "bit 1 output." When the first hunter finds the box, he pushes the button and presto, the CW message changes over to the "fox found," message, which will now be continuously repeated until the controller is "reset." Here in Delaware we have had some devious hunters who have moved the foxbox. In the case of tampering you could even wire up a mercury "tilt" switch to activate a tampering message to warn the other hunters as well as the hider.

LDG mentions to "feel free to program and reprogram" as the EEPROM in the 68HC11 has a life of 10,000 cycles." *LDG warns you, and I will warn you: Be sure to make a copy of the FOXMCW.ASM file before you start changing the parameters.* If you get completely out of whack you can always start over with the original file. Since this is an EEPROM you can remove voltage from the unit and it will still retain the information that you have programmed.

During your programming of the controller you are limited to 75 characters total for the two messages; exceeding this limit during loading results in a friendly error message later. One observer during a hunt stated that he thought the plain CW messages were boring; you can use the letters "E" "T" to produce multiple dits and dahs and set up a rhythm pattern to break the monotony. Again, you can only use 75 characters, and "spaces" count.

Testing

One handy feature of LDG's programming process using your PC is a test command which allows you to test the board for your programming changes without disconnecting from your PC.

During my programming and testing of the board I found an error in the published computations for timing. The Fox Controller instructions used a value of 130 for each minute, and my controller needed a value of 114.5 for each minute for a "tick" value of 1.9 per second. The values on the supplied LDG disk were correct except for the "tick" value information. I talked this over with LDG and it is my understanding that they will correct their timing information on their handouts. For short timing periods this error is not critical, but for a several-hour initial timing computation a correct value must be used.

The timing range was quoted in the instructions to be from 0 to approximately 7.7 hours, but my computations and actual testing indicated a longer range of 9.5 hours. I again notified LDG of this and appropriate corrections will be made. It's fun to hide a box earlier in the day and have it start several hours later on schedule while you are at the hunt starting site. With the programmable timing you can have multiple boxes start up in stages during the day as a complex hunt unfolds. However, due to slight variances of the internal 8 MHz crystal, be prepared to have a slight error during long timing periods, and of course you must "arm" the controller at the proper time by pushing the reset button. The perfectionist can time his or her own board for a one-hour period and come up with the appropriate corrections.

I have abused this board. I left it laying on my desk for a month connected to my PC with a 9 volt battery dangling on the power leads. I abused the board further when I interfaced it to an old commercial 20 watt boat anchor. I hooked the board up using unshielded wires and mounted it next to the transmitter RF section. RF doesn't seem to affect the processor as I positioned a quarter-wave antenna with 15 watts, 3" away from the exposed unit, with no problems. I then wired the controller to the same power supply as the commercial radio internal power supply section, which has a receive/transmit relay on it. The inductive kick of the transmit relay didn't bother the board. Tests conducted with the traditional hot air blower and freeze spray had very little effect. Overall, the board appears to be rugged and pretty bulletproof.

I thought LDG put a lot of thought into the hardware design of their board. There are four of those little rubber feet underneath the board for shock mounting, and your main hold-down bolts go through the RS-232 connector so that the connector is secure when you plug and unplug the bulky cable. The low power CMOS circuitry can be powered by using just a 9 volt battery or any power source up to 20 volts. During testing with the board on the same power supply as the transmitter, the board voltage regulator continued to function to a low voltage level of 7 volts, which is handy if the fox battery starts to wind down during the hunt.

The push-to-talk output of the board is an open collector keying transistor which you can use with a reed relay (Radio Shack 274-232) to allow flexibility in using different radios for the fox, or if your radio allows just grounding the push-to-talk circuit.

The 8 MHz clock crystal oscillator emits a small signal which can be seen with a spectrum analyzer throughout the VHF range. On my controller the signal was at 144.030, 146.030, 148.030 and could be heard about 20 to 30 feet away with a handheld. If this bothers you, you can shield the complete unit in a box with feed-through capacitors. The reason the harmonic was not on an even MHz is a very minute error in the 8 MHz oscillator.

Overall, the LDG board performs as advertised, has lots of documentation, doesn't require a computer genius to program, and tolerates abuse. It is easy to hook up the power, push-to-talk, and audio outputs to your transmitter. For $69.95 you can have an assembled fox controller/CW IDer to create your own personalized system, and at the same time experiment with a microprocessor.

A Delayed Video Trigger for Your Oscilloscope

Convert your surplus scope.

by Joseph A. Consugar KC3XM

When I began working with video circuits, one of the first things I learned is that you cannot just feed a video signal into an oscilloscope and expect to see anything useful. The amount of time most events I was interested in took to occur was so short when compared to one frame of video, it just didn't work.

This problem can be overcome by using a delayed video trigger. This is a circuit that will cause the oscilloscope trace to begin a set time after some event in the video signal. That event is usually the vertical sync pulse, and many oscilloscopes include a delayed video trigger feature. But what do you do if you are using a surplus scope without this capability and don't want to buy a whole new scope just to get this feature? You apply a little ingenuity and build one.

The Basics of Video

To understand how the circuit I came up with works, you should have at least some idea of the structure of a video signal. This is by no means complete, but it should supply enough information so that you can follow the circuit description.

A video display may look continuous, but it is actually composed of a series of still pictures that is going by so fast they all blend together. Each of these pictures is called a video frame, and each frame is made up of two video fields that are labeled the even and the odd. A new video frame is displayed 30 times per second, so a new video field is displayed 60 times per second.

Each video frame is made up of 525 horizontal lines, which are split equally between the video fields. Displaying 262.5 lines of video in 1/60 of a second means each line requires about 63.5 microseconds.

Out of these 262.5 lines, only 244 of them are used to transmit video information. The remaining lines are used for blanking the display during picture retrace and display synchronization. Figure 1 shows the structure of these lines for the even field.

Picture synchronization is performed using sync pulses that are included as part of the video signal, the main ones being the horizontal and vertical sync pulses. Horizontal sync pulses indicate the beginning of a new line of video and vertical sync pulses indicate the beginning of a new field of video. In Figure 1, note the structure of lines 4 to 6. These are the lines when the vertical sync pulse occurs. During these lines, the sync pulses are much wider than normal, which is the key to determining when a vertical sync pulse occurs.

Circuit Description

The steps necessary to produce a delayed video trigger are illustrated by the block diagram in Figure 2. A schematic of the corresponding circuit is shown in Figure 3.

In order to synchronize the trigger with the vertical sync pulse, you must first identify when the vertical sync pulse occurs. This is accomplished by U1, U2, and their associated components.

The video signal is taken from the source of Q1 (an MPF102 JFET whose purpose is to provide buffering for the video source) and fed to the input of U1, an LM1881 video sync separator. The sync pulses are extracted from the video signal and appear at pin 2.

The sync pulses are routed to U2, which is used to separate the vertical sync pulse from the horizontal sync pulses. U2a, R1, C1, and D3 form a one-shot timer that is triggered by the ends of the sync pulses and whose negative-going output pulse is connected to the clock input of U2b, a D type flip-flop. When the signal from U1 returns high at the end of a sync pulse, the one-shot is triggered and its output goes low. The amount of time spent low is determined by the values of R1 and C1.

The sync pulses are also connected to the data input of U2b. When the output of the one-shot returns high, the value of the sync signal is sampled and appears at pin 12. Normally, the sync pulse is narrow compared to the length of the video line and the signal from U1 is still high when the one-shot output returns high. However, during the vertical sync pulse, the sync pulse is wide compared to the length of the video line, so that the next sync pulse has already begun by the end of the one-shot pulse. Therefore, the output of U2b is normally high, except during the vertical sync pulse, when it is low. This sequence of events is illustrated in Figure 4.

At this point there are two pulses for each frame of video, one for the even field and one for the odd field. To ensure a stable oscilloscope display, the trigger must be keyed to the same field (i.e., the even or the odd) each time. This is accomplished by using the vertical sync pulses from

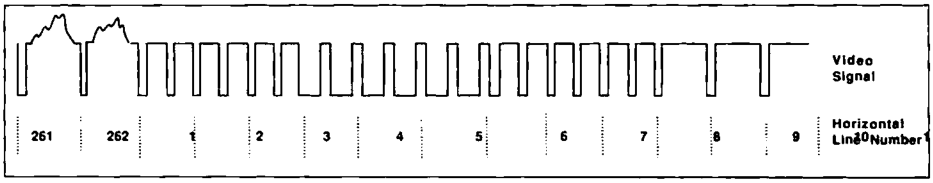


Figure 1. Even-field structure during the vertical interval.

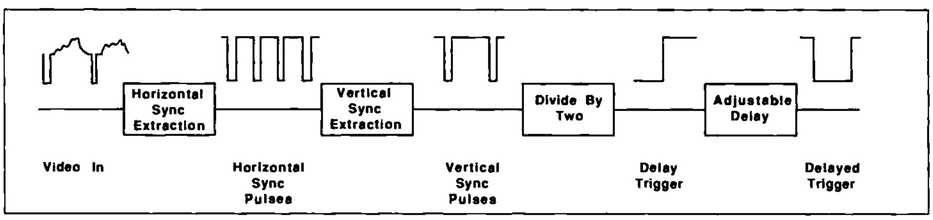


Figure 2. Delayed-trigger block diagram.

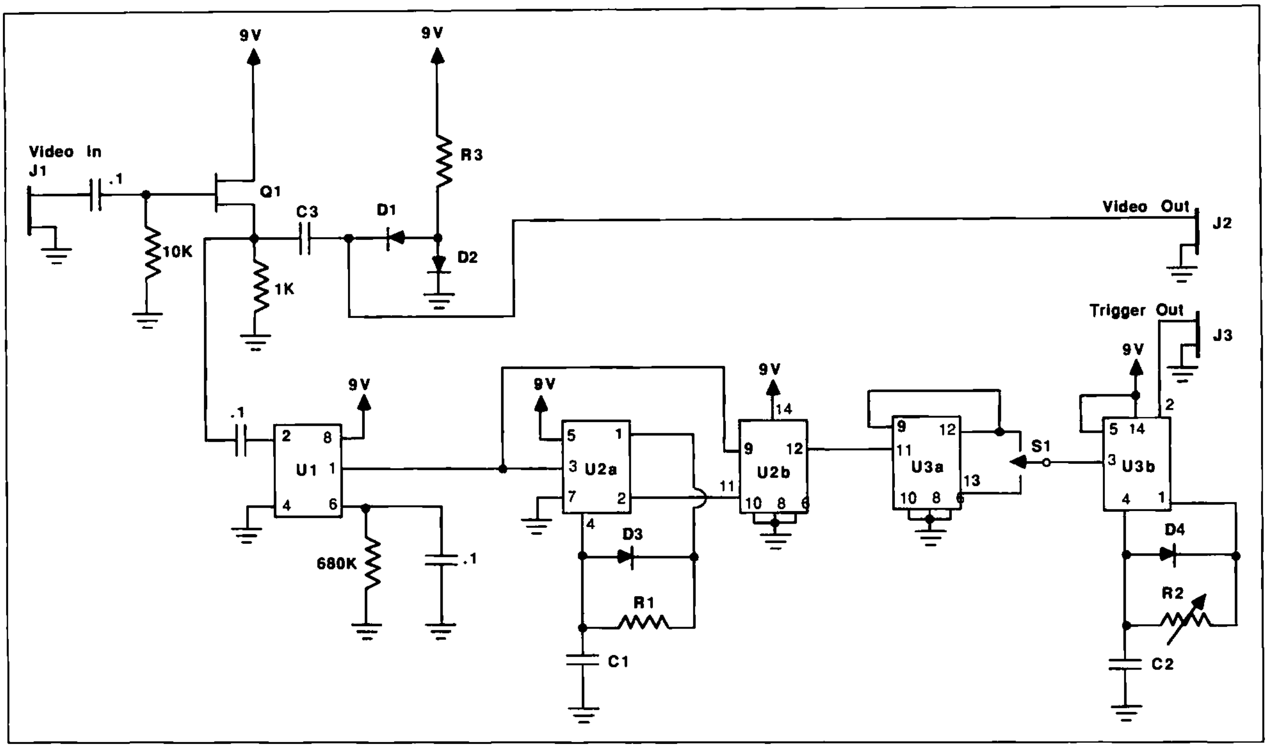


Figure 3. Delayed-trigger circuit schematic.

U2 as the clock for a divide-by-two circuit formed by U3a. Each vertical sync pulse causes the output of U3a to change state. The result is a square wave that goes high once per video frame and can be used as the trigger for the final delay circuit.

The delay circuit is composed of a one-shot timer made up of U3b, R2, C2, and D4. The one-shot is triggered each time the signal from U3b goes high and the pulsewidth can be varied using R2. The end of the pulse is the external trigger for the oscilloscope.

As you look at the schematic, you will notice there are some components whose purposes have not been clarified. D1, D2, R3, and C3 form a video clamping circuit whose purpose is to provide DC level restoration for the AC-coupled video signal. While not strictly part of the delayed trigger circuit, it is useful to keep the oscilloscope display stable when viewing rapidly-changing video signals.

Construction and Use of the Delayed Trigger

The prototype for this circuit was built on a Radio Shack protoboard using point-to-point wiring. Another option would be to make a PC board according to the design in Figure 5. Or you can order one already drilled and etched for $4.25 plus $1.50 S & H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118. I recommend that you build the stages separately and make sure each is working correctly before proceeding to the next.

When you have completed construction, connect a 9V battery to the power connections and a video signal to J1. Adjust R2 to its minimum value and examine the delayed trigger output at J3 with an oscilloscope. You should see a series of very short, negative-going pulses whose width increases as R2 is turned clockwise.

Once you have the delayed trigger working, adjust your oscilloscope to accept a positive-going external trigger. Set R2 to approximately halfway. Connect the trigger signal at J3 to the oscilloscope's external trigger input and the video signal at J2 to the vertical input. Adjust the oscilloscope time base so that there are three or four lines of video displayed on the screen. As you vary R2, you should see different parts of the video signal on the screen. The values given for R2 and C2 should allow you to vary the delay from approximately zero to about one-and-one-half video fields.

Final Notes

When you turn on the circuit and connect a video signal, the trigger will randomly latch onto one of the video fields. If the field being displayed is not the one you want to examine, move S1 to its opposite position and the opposite video field will be dis-

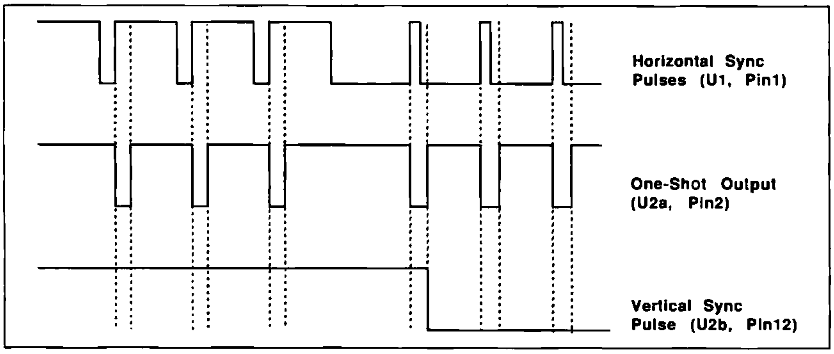


Figure 4. Vertical sync pulse extraction process.

Parts List

R1	3.3k
R2	1 meg potentiometer, linear taper
R3	1k
C1	0.0047 µF
C2	0.033 µF
C3	0.1 µF
D1,D2,D3,D4	1N914 silicon diode
Q1	MPF102 JFET
U1	LM1881 video sync separator
U2,U3	4013 D type flip-flop
J1,J2,J3	RCA phono jack
S1	SPDT switch

Note: Resistors are all 5% 1/4 watt. Capacitors are all polyester type.

played. There is no way to determine which field will be displayed when you turn the circuit on, but you can always get to the one you want.

For those people who are familiar with the LM1881, you may wonder why I didn't take advantage of some of its other features (e.g., the even/odd field indicator). It has been my experience that in order to fully utilize these features, the video signal being examined should conform closely to the video standard. Unfortunately, some video sources (e.g., VCRs and camcorders) take liberties with that standard. The circuit as presented was designed so that, with hope, it would work with as many of these near misses as possible. If you work primarily with standard video, I encourage you to take advantage of the additional features of the LM1881 and share the results with the rest of us.

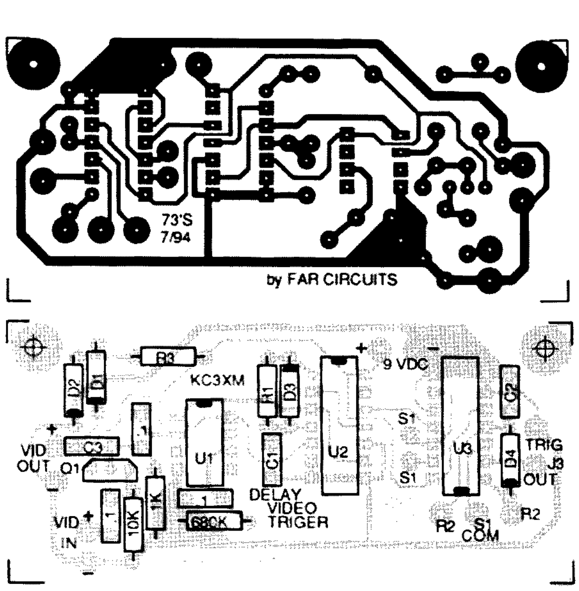


Figure 5. PC board layout and parts placement.

Multiband Half-Wave Delta Loop (MHDL)

A simple 20-10 meter antenna with an 80-30 meter bonus.

by James W. McLelland WA6QBU

While looking through my books for some kind of small antenna that would fit in the attic, I happened upon a short description of half-wave loops. I've always preferred full-wave loops, but a 20 meter one wouldn't fit in my 17' x 25' attic given the fact that I needed to stay away from outside rain gutters, flashing, downspouts, vents and a chimney. As luck would have it, however, I discovered that a half-wave loop fits, with room to spare (I've hung it on my classroom wall as well). While half- and full-wave characteristics are quite different from each other, with the details worked out, the MHDL has proven itself to be an effective indoor reference antenna for the upper (20-10 meter) HF bands. (By the way, there's a slick trick you can use to make it work on 80-30 meters as well.) It's easy to build, requires no alignment, and the XYL can't see it. Try it. This'll be the easiest antenna you've ever built.

Description

The loop is cut for a half wave on 20 meters. Half-wave loops have a very high impedance, in the order of 2,000 ohms, so I needed to bring the impedance down to a more workable value. Using a quarter-wave (including a velocity factor of 0.80) transmission line transformer will drop the impedance to about 50 ohms. I used 300 ohm twin lead (Radio Shack 15-1153) because it works well into a tuner, is inexpensive and has low loss. On 10 meters, the 20 meter half wave becomes a full wave and the impedance drops to about 100 ohms, the feedline is now half-wave and acts as a 1:1 transformer, which your tuner will have no trouble matching. I also found that my tuner could easily resonate and match the MHDL on 17, 15, and 12 meters. If you use a 3/4-wavelength feedline, you can also get an 80-30 meter bonus by shorting the two feedline wires together and tuning it as a top-loaded vertical. This gives you a vertical 3/4 wave on 30 meters, a half wave on 40 meters and a quarter wave on 80 meters. However, you must use a ground to make this mode effective. By the way, it's about 1/8 wave on 160 meters and your tuner might be able to add enough inductance to make it resonate. Anyway, it's worth a try.

Construction

Using insulated #16 or #18 gauge stranded wire, cut the loop to 35' 4" (see Figure 1). Now cut the 300 ohm feedline to odd multiples of 13' 8" (exactly 41' for the 80-30 meter bonus). Solder the feedline to the loop ends and insulate with shrink tubing. Then, to connect it to the balun on my tuner, I installed two banana plugs (the kind that plug into each other) on the end of 6" pigtails, soldered them to the twin lead, and then insulated them with shrink tubing. You'll be done with the construction phase in less than an hour.

Installation

This is the part where you can really get creative. You might even hide the feedline and convince the XYL that your MHDL is a rosebush trellis, but then you'll have to plant and take care of the roses. I opted to hang mine horizontally from the rafters. There is no exact shape requirement except to have as much area as possible. I like equilateral triangles, but squares, diamonds, circles and rectangles work just fine. Changing the shape varies the frequency somewhat (plus or minus 1/2 MHz or so) but I just let my tuner fix it. More important is that the loop fits the space you've got no matter what it looks like and what angle it's mounted at—vertical, horizontal, or somewhere in between. One warning: Stay away from metal objects with the MHDL and feedline, and mount it with some kind of insulating material. If you have extra room, try a vertical and a horizontal model, at least for 20-10 meters. Being able to switch back and forth can really be dramatic because the angle of radiation as well as the polarity will be different. Lastly, if you go for the 80-30 bonus, the feedline should be somewhat vertical and stretched out, but the higher part could be horizontal and work OK. In any case, it's a lot better than nothing and it's all hidden indoors.

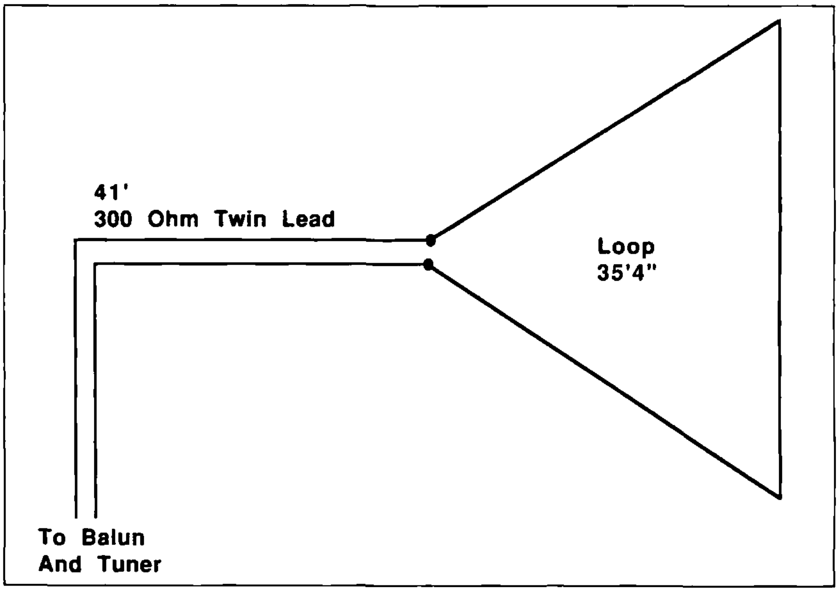


Figure 1. The Multiband Half-Wave Delta Loop.

Parts List

Quietflex #14 antenna wire	36'
Kilowatt 300 ohm twin lead	41'
Shrink tubing, 3/8"	1'
Shrink tubing, 3/16"	1'
Banana plugs	2
Dacron line	50'
Egg insulators	4

Note: All parts needed to build this antenna can be obtained by ordering the Multiband Half-Wave Delta Loop Experimenter's Kit from Antennas West, 1500 N 150 W, Provo UT 84604; Tel. (801) 373-8425. Introductory price w/shipping (40% discount for *73* readers): $24.

Tuning

There really isn't anything that you need to tweak on the MHDL. Sure, you could use a fancy antenna bridge to trim it for 20 and 10 meters once it's installed, but you've got to use a tuner for the other bands anyway, so why bother? For 20-10 meters, just connect it to the balun terminals and tune for minimum SWR with the lowest power you can (check for a clear frequency first), then look for a QSO. On 80 and 40 meters, plug both banana plugs together into the single-ended "wire" terminal on the tuner and connect it to the best ground you can get. For easy band changes, I keep my setting written on a card next to the tuner. It tunes quite broadly so one setting for each band gets me close enough to get started, and then touching it up is very easy.

Testing

Does it work? You bet it does! I've worked as far west as central Russia and as far east as Czechoslovakia, or is it the other way around? North to Alaska, and south to Argentina. New Zealand and Australia were also no problem. OK, OK! I know. The bands aren't as good as they used to be, but it still is a pretty good antenna for being in my attic and if you don't like it maybe the XYL can hang clothes on it—hey, wait a minute! I think I've got an idea. 73

The Improved Resonant Feedline Dipole

A compact, low impedance, end-fed HF antenna that needs no tuner!

by James E. Taylor W2OZH

The end-fed RASER antenna described in *73 Amateur Radio* (September 1992, pp. 8-14) utilized the RFD (Resonant Feedline Dipole) approach. This concept has drawn an enthusiastic response from hams throughout the country. It achieves an end-fed dipole, or a RASER, for any band desired *using a coaxial feedline and without a tuner*. It has been praised by many who have site restrictions which preclude the use of the customary dangling center feedline. A unique feature of these antennas is the use of the T-choke—eg.: a 13-turn coil of coax which is suspended at the input end of the radiator. If, however, you find such a coil cumbersome the present article offers help!

The RFD Concept

As mentioned in the previous articles, an obvious approach to the electrical isolation of the input end of the dipole might involve the use of a current balun. However, calculation showed that this direct approach would not provide sufficient impedance. At that time I chose to use the somewhat more bulky T-choke method of isolation. Nevertheless, the idea of making a more compact choke was rekindled when I found an article in my files by Joe Reisert W1JR (*Ham Radio*, September 1978, pp. 12-15). That article described "a new type of balun" which featured a high permeability toroidal core wound with coaxial cable using opposed windings for reduction of external field, as shown in Figure 1. Based upon that idea, I made a few comparative impedance calculations, which were encouraging. Experiments then led to a simple practical design in which the T-choke is replaced by a compact box.

I will describe the final design of the RFD antenna for the 80 meter band in some detail, and tabulate the results of the calculations in the "Calculations" sidebar. Also included is a tabulation of the calculated number of turns and lengths of the dipole halves for the other popular HF amateur bands.

The Design

In the previous design of the RFD the self-resonant T-choke served two related functions: It gave the high impedance required to isolate the end of the dipole, and it provided the reactance which tuned the system to resonance, thereby enabling an excellent impedance match to the feedline. In the Improved RFD design these functions are achieved by adding a fixed resonating capacitor in parallel with a winding of coax on a toroidal core, as in Figure 1. First, calculation shows that if we use the Type T-200-2 powdered iron core commonly used for baluns in this frequency range the inductance would be an order of magnitude lower than that for the T-choke. Even two such coils in series, tuned to resonance using a 264 pF capacitance, is lower by a factor of five. In spite of this I temporarily wound two 13-1/2-turn coils on these cores for preliminary experiments. The results confirmed the feasibility of the approach but the measured common mode current on the feedline was too high. (The MFJ H-field Antenna Probe is convenient for comparing these currents). However, during this test an important fact was determined—*in order to get the desired 1:1 SWR it was necessary to place a current balun in the line ahead of the tuned coils*. For this I used a 20-turn bifilar coil on a T-200-2 core. This current balun provides impedance balance relative to RF ground.

Further review of the Amidon data sheets indicated that we must consider ferrite material, which provides higher permeability, in order to get the higher inductance desired. However, this comes at the expense of some reduction in temperature stability. The FT-240-61 core was chosen for our desired power levels and frequency range. This core has an initial permeability of 125, and with a core o.d. of 2.4 inches it should handle a kilowatt of power without excessive heating. The calculation of inductance of a 12-turn coil on such a core gave a value of 25 microhenries—much greater than that of the powdered iron cores and even greater than that of the RFD T-choke. Since the loss resistance is roughly a factor of five less than that for the original RFD, the calculated prognosis for the Improved RFD is very promising! (See the Coil Tester comments at the end of this article.)

Construction and Adjustment

For the final coil I wound 6 + 6 turns of RG-8(M), field-opposed, on an Amidon Type FT-240-61 toroidal core (see Figure 1). This coil was mounted in a 6" x 3-3/16" x 1-7/8" plastic box along with the current balun referred to above and the two coax sockets, as indicated in Figure 2. For the

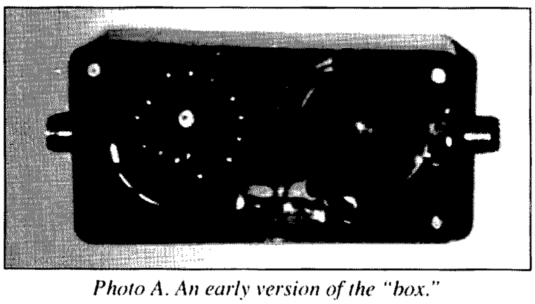


Photo A. An early version of the "box."

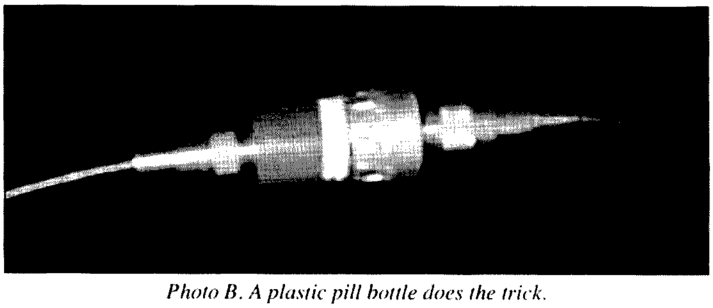


Photo B. A plastic pill bottle does the trick.

simple bifilar current balun I wound 20 turns of sheathed bell wire on the T-200-2 core, shown schematically in Figure 3. The general packaging is shown in Photo A, which is of an early model. Figure 4 shows the schematic diagram of the circuit. The simplicity of the circuit is apparent—other than wire and coaxial cable fittings, there are only five parts!

I have found that a plastic pill bottle (the popular amber-colored cylindrical one with the locking cap) makes a very useful center insulator for this type of dipole. I mounted SO-239 sockets on the bottom and the top of the box. Connections are as indicated in Figure 5. Photo B shows this compact, rugged assembly. The unit can withstand a surprising amount of tension and the parts are conveniently disconnected, when desired. Figure 6 shows the complete antenna.

The only adjustment required was the choice of the tuning capacitance connected across the coil of coax on the ferrite core. I made a preliminary adjustment by using an air variable across the coil on the bench, and using the coil tester described at the end of this article. I then made the final adjustment with the antenna in place and with the plastic box lowered to stepladder height, using an SWR bridge to indicate 1:1 SWR. These adjustments agreed to within about 10%. The air variable was then replaced with fixed silver micas and the box was raised to normal height. (Since the voltage across this capacitor is high I placed two equal capacitors in series.) For my installation 50 picofarads (2 x 100 pF in series) brought the resonance within 15 kHz of the desired frequency of 3.953 kHz.

Photo C. The radiator, suspended by two 40-foot-high masts. The box is at the lefthand mast and the center insulator is near the righthand mast.

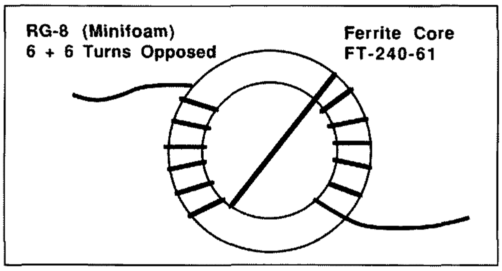


Figure 1. The Improved RFD Antenna's coil.

Results

The adjustment and operation of the Improved RFD Antenna on 80 meters was straightforward and satisfactory in all respects. The radiator was suspended between the two 40-foot-high masts which support the two RASER gain dipoles at W2OZH. This can be seen in Photo C, where the box is at the lefthand mast and the center insulator is near the righthand mast. The "terminator" half of the dipole slopes downward off of the photo to the right. (The segmented sections sloping out of the photo from the righthand mast are not part of this antenna system.)

It was interesting to observe the action of the tuning capacitor in limiting the shield radiation and matching the radiator to the feedline. The shield current was indicated by the MFJ H-field probe and the match was measured by an SWR bridge while turning the air variable capacitor. At resonance the shield current showed a sharp null. Also, the SWR was a flat 1:1 at a point slightly off

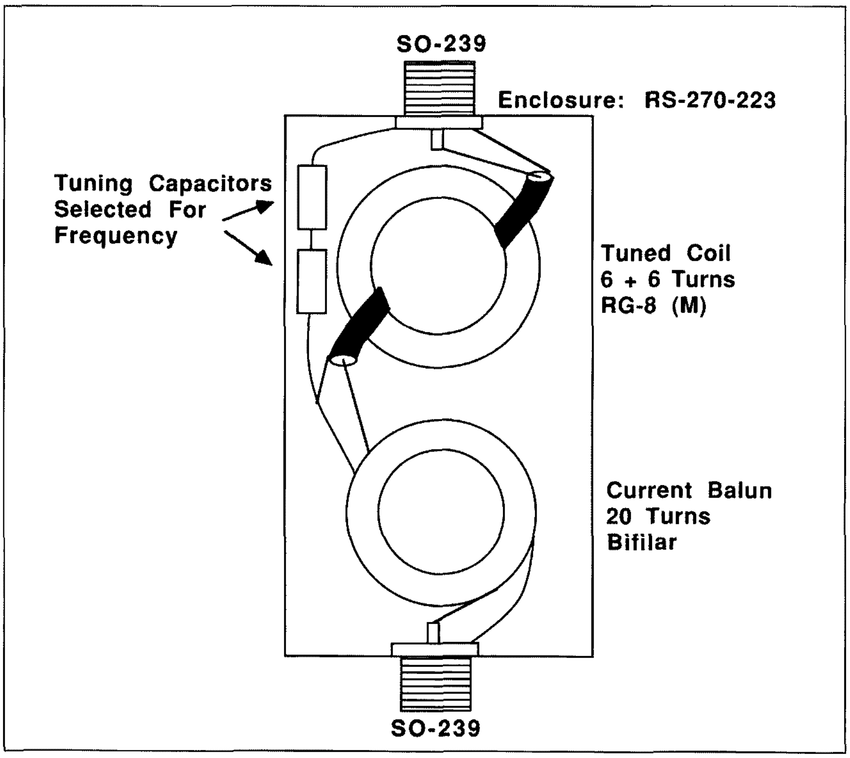


Figure 2. Connect the transceiver to the bottom of the box.

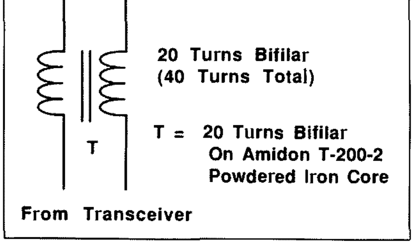


Figure 3. Schematic for the current balun.

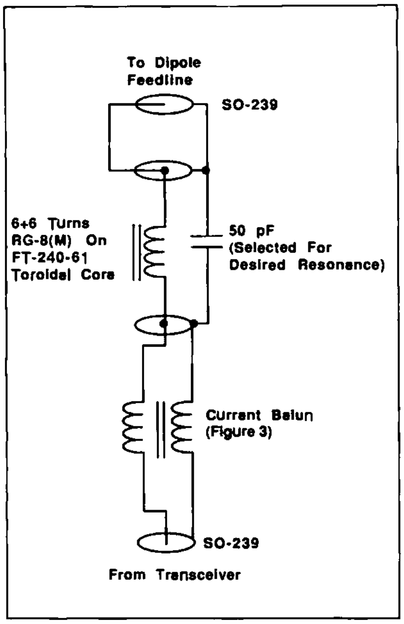


Figure 4. Schematic for the Improved RFD's box.

Specifications for Other Bands

Band	Freq.	Turns	Dipole Half Length
160m	1.9	17	123'2"
80m	3.954	12	59'2"
40m	7.263	9	32'3"
20m	14.29	7	16'5"
17m	18.14	6	12'11"
15m	21.38	5	10'11"
10m	28.65	4	8'2"

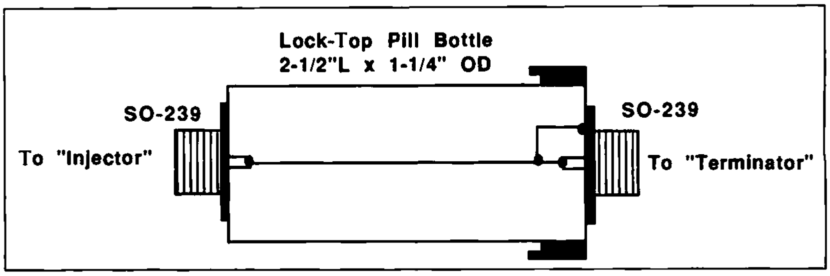


Figure 5. Center insulator assembly.

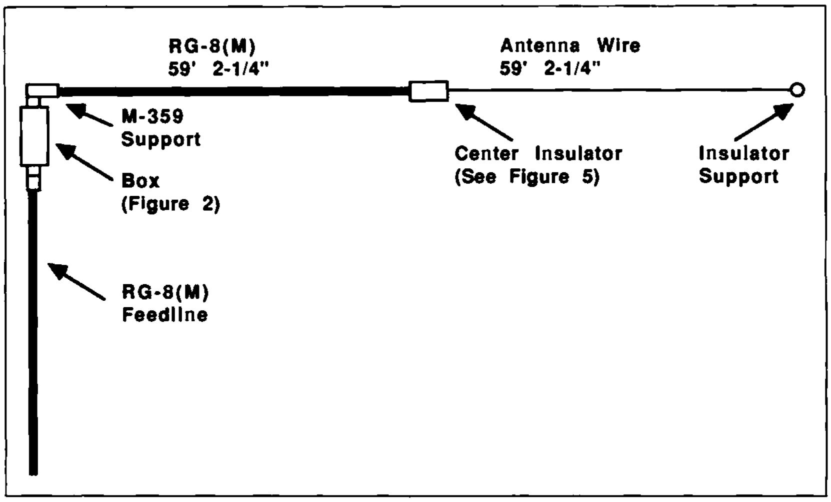


Figure 6. Improved RFD Antenna (for 3.9535 MHz).

Parts List

Description	Part Number	Optional Supplier
1 ferrite core	FT 240-61	Amidon Associates
1 powdered iron core	T-200-2	Amidon Associates
1 enclosure box	270-223	Radio Shack
1 plastic pill box	1-1/4" o.d., 2-1/2" H	Any pharmacy
Silver mica caps	Assorted (100/$5)	Fertik's, 5400 Ella St., Phila. 19120
Antenna wire	#14 stranded	Radio Shack
4 coax sockets	SO-239	Radio Shack
5 coax plugs	PL-259	Radio Shack
5 coax reducers	UG-176	Radio Shack
1 right angle conn.	M-359	Radio Shack
Coaxial cable	RG-8 (Minifoam)	Radio Shack
Twin bell wire	(Sheathed)	Any home supplier

Calculations

Item	Equation	Value
13 Turn T-Choke:	$L = a \times n^2 \times J =$	20 μH
	$Z_{i\,(OLD)} =$	$25 \times 10^4/R_{1\,(OLD)}$
2 x 13.5 Turn T200-2: (i.e. IRFD1)	$L = 10^{-4} \times N^2 \times A_L \times 2 =$	4.3 μH
	$Z_{i\,(RFD1)} = L/C \times R_1 =$	$2.4 \times 10^4/R_{1\,(IRFD1)}$
6+6 Turn FR-240-61: (i.e. IRFD2)	$L = 10^{-6} \times N^2 \times A_L =$	25 μH
	$Z_{i(IRFD2)} = L/C \times R_1 =$	$64 \times 10^4/R_{1\,(IRFD2)}$
Z Comparison:	$Z_{i(RFD1)}/Z_{i(RFD2)} =$	0.25
	$Z_{i(IRFD2)}/Z_{i(RFD1)} =$	12.5

resonance, as expected. Noise bridge measurements confirmed this resonant frequency and indicated an input of 52 ohms. The measured bandwidth of the system was 170 kHz between the "SWR = 1.2" points, which is very acceptable. The common mode shield current was appreciably less than for a standard well-balanced center-fed dipole. Stations worked reported no difference in signal strengths between these dipole antennas.

Conclusion

The Improved RFD Antenna is an end-fed dipole using coaxial cable without a tuner. It achieves the same advantages as the original RFD system, while replacing the T-choke coil with a compact box. It also provides a more convenient method of adjustment to resonance.

I wish to acknowledge the patience of the number of hams who gave signal strength comparisons which confirmed the viability of the design.

Coil Tester

Michael Covington (*73 Magazine*, Sept. 1990, pp. 48-51) described a simple coil tester which gives a direct measurement of the resonant frequency of a parallel-tuned coil. This tester, together with my Alfa digital multimeter (which measures frequency up to 20 MHz) gave a direct preliminary measurement of this antenna's tuned-coil frequency.

Core Kit

The two toroidal cores for the Improved RFD are available as a kit from Amidon at a reduced price of $12 by referring to this article. ■

RTTY LOOP

Number 12 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Over the past few months, we have looked at a few shareware programs for RTTY. This month, let's take a look at a commercial package—a package that offers quite a bang for the buck.

The program is BMK-MULTY, a PC program for running RTTY with an ordinary "dumb" terminal unit and an IBM-compatible computer. Developed by G4BMK, who has been writing RTTY software for many years, this program takes advantage of the processing power in the personal computer to integrate the functions of a terminal node controller into the software.

With this setup, some of the problems associated with the hardware of a TNC, such as extra RF noise, is eliminated. This presumes, of course, that your computer is adequately shielded. Since the computer itself is the TNC, communicating with the demodulator is integral to the system, eliminating concerns over internal baud rate, data bits, and the like.

Let's take a look at this package and see just what it can do. First off, as noted, it will run on just about any PC-compatible, from the oldest 8088 running at 4.77 MHz to the latest superhot screamer. Some highly intense modes, such as PacTOR and SSTV, however, may not run well on a slow machine. While not rated to run under Windows, some users have been able to make this work with a fast computer and full screen display.

I have alluded to the modes that BMK-MULTY supports, so I suppose I should give you some details. How about RTTY, CW, AMTOR and PacTOR, with a standard demodulator, such as the CP-1 we have been talking about, or a Hal ST-5 or ST-6, Flesher TU-170 or TU-470, iRL FSK-1000, Heath HD-3030, or even an old home-brew? There is even an extended audio package that includes an audio spectrum analyzer, with reception of HF WEFAX and SSTV.

A "Logger" module includes a callsign and QSO database, which operates within the communications program. Captured callsigns that are already in the database are so indicated, and a pop-up window is available to enter QSO data as needed.

Multi-sampling algorithms in both the RTTY and CW modes are used, to ensure the best possible reception under the most difficult conditions. The display can be configured to the user's preference, whether a split-screen display with separate receive and transmit windows, or a simulated teleprinter, with all combined in one display. Functions and features are accessed with function and ALT key combinations.

BMK-MULTY is the only commercially available software that I am aware of that implements AMTOR with a dumb terminal unit. While using advanced programming techniques, the program is capable of surpassing the performance of compromise designs within multi-mode controllers.

Another mode, PacTOR, combines the features of AMTOR and packet radio. Unlike straight packet, PacTOR, which is highly effective on the HF bands, runs at 100 or 200 baud, depending on the conditions. With data compression, PacTOR can achieve data transfer rates more than three times higher than AMTOR. With handling of the full ASCII character set, PacTOR allows full text, and even binary, data transfer, all with the lowest chance for error.

Now, I have indicated that BMK-MULTY works with almost any garden variety RTTY demodulator. But what about the ham who has invested in a multimode controller. Many RTTY-active hams no longer have an ST-6 on the shelf. Well, Schnedler Systems, the source for BMK-MULTY, has produced an adapter board for the AEA PK-232 which allows access of the modem section of the PK-232, bypassing the TNC and data processing logic built into the box. While this might seem like a step backward, the truth is that for the modes that BMK-MULTY supports, this really does create an enhancement.

The adapter itself is a small, "L" shaped printer circuit board that is installed as a pass-through device between the PK-232 and the computer. A short jumper connects to the "external modem" connector on the back of the PK-232, and inside the PK-232, shorting blocks are installed to change the logic of data flow. A push-button on the board sets things back to "normal" for conventional PK-232 operation, such as with packet.

Now, you can order all of this from Schnedler Systems, AC4IW, 25 Eastwood Road, P.O. Box 5964, Asheville, North Carolina 28813. The base communications package, which includes AMTOR, RTTY, CW, and the logger sells for $95. The base package plus PacTOR is $145. The base package plus the extended audio package is $140. And all three packages together go for $175. The PK-232 adapter board is $49. These prices are correct as of this writing, and do not include shipping. I would advise you to contact Schnedler Systems for current information on pricing, shipping and availability, letting them know, of course, that you read about it in *73* magazine's "RTTY Loop"!

Now, here's a follow up to material we've covered in recent months. I received an E-mail message from John Skubick K8JS via America On-line. Jack reminds us that computer ports are fairly standard. When looking at devices such as modems, TNCs, printers, and the like, if it can plug into the serial port of a PC-compatible computer and work, than this same hardware should work as well on an AMIGA computer, or any other computer that supports standard port pin assignments. Thanks to Jack for that tip, which he directed to me through Internet.

And, while we're on the subject of terminal units, here's a question received via E-mail on Delphi: Emory WA4TTO has been reading *73* magazine since 1976. Back in 1978 or 1979, he built a DT-600 demodulator, by Data Technology Associates, from scratch based on the documentation. He says that it far out-performed any other RTTY demodulator that he has been able to construct. Since he lost the documentation years ago, and someone disposed of his DT-600 when he was indisposed, he has been unable to duplicate the device. If there are any readers out there with information about this demodulator, we would love to hear from you, as would Emory, I am sure.

A brief note about the growing collection of RTTY programs available to the readers of this column: There are now five "RTTY Loop" disks, each one holding over 1.2 Mb of assorted stuff. A list of available programs is yours for a self-addressed, stamped envelope. I can E-mail you the list, as well. Just send me a message via CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR), America On-line (MarcWA3AJR), or Internet (MarcWA3AJR @aol.com). The plans are to upload the collections, as well, to the Delphi Radio SIG detailed last month.

I've waited until the end of this column to toot my horn. This month marks the beginning of the 18th year of "RTTY Loop." I guess it can vote now! I can't begin to tell you what it means to get the support I have been receiving for these many years. I look forward to your letters, your E-mail, your questions and your criticisms. I hope that we are able to spend more time together in the future, to explore the wide world of digital communications, here in "RTTY Loop."

HAMSATS

Amateur Radio Via Satellites

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The Digital Satellites

Digital communication via the amateur-radio satellites has been around since the early days of packet-radio activity. Before the first ARRL (American Radio Relay League) Amateur Radio Computer Networking Convention in 1981 at the National Bureau of Standards in Gailhersburg, Maryland, AMSAT (The Radio Amateur Satellite Corporation) earmarked Special Service Channels (SSCs) on future high-orbit satellites for packet communications. Dr. Hank Magnuski KA6M, designer of one of the first packet digipeaters, was in charge of setting standards for SSC use. This came at a time when AMSAT was still recovering from the loss of Phase 3A in 1980, which was to be the first high-orbit, long-life hamsat. Phase 3A met a watery end when its Ariane Launcher failed to achieve orbit.

Packet operation through analog satellite transponders is comparable to direct user-to-user packet procedure. Early tests were made at 1200 bps (bits per second), but activity at 300 bps using HF modems was more reliable, due to the weak-signal nature of satellite communications at the time. The use of the analog transponder space for packet experiments was never popular. The store-and-forward potential of the AX.25 packet protocol was not addressed via the analog transponder system. A digipeater in space, or some other digital mailbox setup, was needed.

At the 1983 ARRL Amaleur Radio Computer Networking Convention in San Francisco, Phil Kam KA9Q presented the paper "Modulation and Access Techniques for PACSAT," while Don Connors KD2S presented the "The PACSAT Project." Don's paper described the design goal of "total global access by all hams to a store-and-forward packet message handler" via satellite. He explained the need for packet satellites and characterized the on-board systems and technical parameters for the required equipment.

Phil's paper on modulation techniques, when viewed with Don's, laid down the blueprint for many of today's digital satellites, from frequency selection to modulation methods. It was shown that a form of phase-shift keying (PSK) would perform better than standard audio-frequency-shift keying (AFSK) on an FM carrier for packet-satellite downlinks. AFSK-FM has advantages that include cost, simplicity and easy Doppler tracking, but it has some tradeoffs. These include inefficient bandwidth usage and poor noise performance. Today we have satellites that use both types of downlink schemes. All are in low earth orbits.

In 1984 when UoSAT-OSCAR-11 (built by the University of Surrey in England) went to orbit, it carried the Digital Communications Experiment (DCE) which provides a proof-of-concept test-bed for PACSAT work. The experiment acts as a mailbox in orbit to try various digital communication software and to provide data on hardware survivability, current consumption and operational behavior in space. Only a small number of hams around the world are active as gateway stations through the DCE, but others can route their messages to these gateways for uplinking to U-O-11. The concept not only worked in 1984, but is still operational today. Messages can sometimes be seen between telemetry frames on the 145.825 MHz downlink at 1200 bps.

When Fuji-OSCAR-12 was launched in August 1986 from Japan, hams had their first opportunity lo find out what PACSATs were all about. Whenever the "J" (2 meters up and 70 cm down) digital transponder was active, stations could access the mailbox and leave messages for hams next door or on the other side of lhe world. The system used FM for the uplink and PSK on the downlink. Signals were good but battery problems made continuous activity impossible. After only a day or two the system needed recharging with corresponding down periods and loss of all the messages in memory. Even with these difficulties, the open digital mailbox was an exciting packet experience. Fuji-OSCAR-20 was launched in February 1990 as a replacement for F-O-12. F-O-20 also has battery and heat problems requiring some downtime, but it is quite active today for those wishing to use an orbiting digital mailbox without special software.

In January 1990 the first batch of four Microsats were launched by an Ariane rocket as secondary payloads. Two new UoSAT's were also passengers. Sent aloft were UoSAT-OSCAR-14, UoSAT-OSCAR-15, AMSAT-OSCAR-16, DOVE-OSCAR-17, WEBER-SAT-OSCAR-18 and LUSAT-OSCAR-19. Today A-O-16 and L-O-19 provide 1200 bps operation using FM up and PSK down. Special PC-based, broadcast-protocol packet software is required to communicate with these satellites. W-O-18, sponsored by Weber State University in Ogden, Utah, sends images in a special binary format. D-O-17, sponsored by AMSAT-Brazil (BRAMSAT), currently transmits telemetry that can be heard on 145.825 MHz FM. A standard amateur-radio TNC (Terminal Node Controller) in conjunction with a computer or terminal and an FM receiver can be used to see the data and messages from this hamsat. DOVE is also capable of speech, but has yet to fulfill its potential, due to minor hardware difficulties and software needs. Work continues on Dove's recovery. U-O-15 died shortly after launch and, although U-O-14 is currently in commercial service on non-amateur frequencies, it provided digital hamsat chasers their first opportunity to try 9600 bps communications with FM up and down, using the broadcast protocol.

AMSAT-OSCAR-21 provided the first operational German RUDAK system. RUDAK is a complex RISC-based (Reduced Instruction Set Computer) digital transponder. It can be programmed to accept uplinks of many types ranging from analog voice to high-speed digital data, with a corresponding wide range of downlink options. While it spends the largest percentage of its time in a voice transponder mode with a downlink of 145.987 MHz FM, it has also sent packet telemetry, WEFAX transmissions of uploaded images, and prerecorded voice messages. A-O-21 is a part of a Russian navigational satellite and another amateur-radio payload, RS-14. The voice uplink to A-O-21 is on 435.016 MHz.

Several other digital satellites have been launched in recent years. UoSAT-OSCAR-22 is used for 9600 bps operation as a replacement for U-O-14. The majority of the traffic on U-O-22 is terrestrial packet mall forwarding.

Kitsat-OSCAR-23 is another 9600 bps satellite with the highest orbit of the digital hamsats. This satellite was built at the University of Surrey in England but was sponsored by the Korean Advanced Institute of Technology (KAIST). Files found on K-O-23 include short text messages, utility software, picture files, music (midi) files, voice mail and even game programs. If it's digital, it's probably been sent via K-O-23. Kitsat-OSCAR-25 is almost identical to K-O-23, with a slightly lower orbit and more advanced hardware. Both satellites have on-board cameras for earth-imaging experiments.

ITAMSAT-OSCAR-26 is another microsat-style satellite. It was built by AMSAT-Italy. It currently uses 1200 bps with FM up and PSK down with the broadcast protocol. It can also operate at higher data rates when appropriate software is checked out. I-O-26 is fully capable of the popular FM-up/FM-down 9600 bps format of the UoSATs and Kitsats. In addition, a telemetry decoding program known as TLMDCITA is available from AMSAT-Italy.

AMRAD-OSCAR-27 was built by Interferometrics and the Amateur Radio Research and Development Co. (AMRAD of McLean, Virginia) in the Washington, DC, area. It is primarily a commercial microsat with amateur-radio capabilities. Most daytime operation is ham-related as a single-channel FM voice transponder with a 145.850 MHz uplink and 436.800 MHz downlink. It is capable of high-speed data operation experiments and is used on non-amateur frequencies as EYESAT to demonstrate the usefulness of store-and-forward commercial communications with low-orbit satellites. A telemetry decoder program is available from the AMRAD BBS at (703) 734-1387 or via anonymous ftp through the Internet at ftp.funet.fi or ftp.digex.neL

POSAT, sometimes called POSAT-OSCAR-28, is a UoSAT-based satellite from Portugal. Like A-O-27, it has commercial uses and shares its time in orbit between ham and industry-related activities. It has been operational on ham frequencies at 9600 bps.

Finding More Information on Digi-Sats

The unique types of digital hamsats in orbit require different hardware and software. It is beyond the scope of this introduction to detail all the requirements. Fortunately, there are several sources of information on how to get active via these satellites. AMSAT-NA has several books and software programs to provide advice on how to begin. The *Satellite Experimenter's Handbook* by Martin Davidoff K2UBC is published by the ARRL and provides good general information on satellites with specifics covering the amateur-radio satellites and packet satellites. *Decoding Telemetry from the Amateur Satellites* by G. Gould Smith WA4SXM gives in-depth coverage of telemetry systems on the amateur satellites, with emphasis on the digital hamsats. The *Pacsat Beginner's Guide* explains the methods of communicating with packet satellites and includes a disk containing the PC software for the broadcast protocol. "Getting Started in Amateur Satellites" is a VHS video tape from CQ Communications that covers all modes of satellite operation and includes demonstrations of the broadcast protocol via digital satellites. Tracking software is also available from AMSAT for most types of computers.

Many articles in *QST, CQ, 73 Amateur Radio Today, Worldradio, QEX, OSCAR News (AMSAT-UK)* and *The AMSAT Journal* (AMSAT-NA) have been written over the last 10 years describing past, present and future amateur-radio digital satellites. The January/February 1994 issue of *The AMSAT Journal* contained a complete *AMSAT Journal* index compiled by WA4SXM. Over 20 articles about digital satellites in a four-year period are noted. The "Hamsats" column in *73 Amateur Radio Today* has featured digital satellite updates several times. Note Table 1 for a current list.

Getting Started

There are several easy ways to get started with the digital satellites. If you have a Bell 202-style modem and can modify it for mark and space bit inversion, you can monitor U-O-11 on 145.825 MHz FM. The satellite sends ASCII data at 1200 bps. The continuous data and messages can be easily

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Table 1. Digi-sat "Hamsats" columns in 73 Amateur Radio Today.

received, and even captured for later study using a computer in conjunction with communications software that can work with the modem.

D-O-17's standard AX.25 packet downlink is also on 145.825 MHz FM. Power levels from the satellite are typically 10 times stronger than U-O-11 and can be heard on almost any antenna. Anyone who is currently active on VHF packet can hear the signals and see the resulting telemetry and messages on a CRT or other display device. For those who can capture the data to disk, programs are available to decode the data and display information on the satellite's activities and health. One program available from AMSAT-NA for $20 is TLMDC-II. All of the data channels can be decoded and examined with this program.

The Russian *Mir* space station has a packet BBS (Bulletin Board System) on 145.55 MHz. Like *DOVE*, the downlink is AFSK FM and is compatible with a standard TNC, but is fully interactive like a terrestrial packet BBS.

When the space shuttle takes SAREX (Shuttle Amateur Radio EXperiment) to orbit, one mode of operation is the packet ROBOT. The downlink is 145.55 MHz, but unlike *Mir*, the uplink is different. Earthbound stations must transmit on 144.49 MHz to connect to the SAREX TNC.

Table 2 is a list of the digital-ready hamsats. The list is not complete, but shows the principal activity of each satellite and typical frequencies of operation. For 1200 bps FM/PSK operation, a special modem is needed in addition to the usual TNC, computer, radios and software. These PSK modems are available from Tucson Amateur Packet Radio Society (modem kit), PacComm (add-on modem), L. L. Grace Communications Products (DSP unit) and others. For 9600 bps activity, a high-speed modem is required, along with some modifications to the TNC, transmitter and receiver. High-speed modems and complete 9600-bps TNCs are also available from TAPR (kit), PacComm (add-on modem), Kantronics, AEA (DSP unit) and L. L. Grace (DSP unit). Some devices, like the DRSI DPK-9600 TNC, are much more difficult to properly interface for satellite work, due to their emphasis on terrestrial-style hardware compatibility.

Satellite	Uplinks	Downlinks	Current Activity and Notes
U-O-11		145.825	1200 bps ASCII (Bell 202)
		435.025	
		2401.500	
U-O-14			9600 bps commercial service
A-O-16	145.900	437.051	1200 bps FSK/PSK "PB"
	145.920	437.026	PB call = PACSAT-11
	145.940	2401.143	PG call = PACSAT-12
	145.960		
D-O-17		145.825	1200 bps FSK AX.25 data
		2401.220	
W-O-18		437.075	1200 bps PSK binary data & pix
		437.100	
L-O-19	145.840	437.150	1200 bps FSK/PSK "PB"
	145.860	437.125	PB call = LUSAT-11
	145.880		PG call = LUSAT-12
	145.900		
F-O-20	145.850	435.910	1200 bps FSK/PSK AX.25 BBS
	145.890		
	145.910		
A-O-21	435.016	145.983	FM Voice transponder (see text)
U-O-22	145.900	435.120	9600 bps FSK "PB"
	145.975		PB call = UOSAT5-11
			PG call = UOSAT5-12
K-O-23	145.850	435.175	9600 bps FSK "PB"
	145.900		PB call = HL01-11
			PG call = HL01-12
K-O-25	145.870	436.500	9600 bps FSK "PB"
	145.980	435.175	PB call = HL02-11
			PG call = HL02-12
I-O-26	145.875	435.867	1200 bps FSK/PSK "PB"
	145.900	435.822	PB call = ITMSAT-11
	145.925		PG call = ITMSAT-12
	145.950		
A-O-27	145.850	436.800	FM Voice transponder (see text)
P-O-28	145.925	435.250	9600 bps FSK "PB"
	145.975	435.275	PB call = POSAT1-11
			PG call = POSAT-12
MIR	145.550	145.550	1200 bps AX.25 BBS
SAREX	144.490	145.550	1200 bps AX.25 ROBOT

Table 2. The Digital Hamsats' current activity. Primary downlink frequencies (MHz) are shown first. All uplink frequencies are simultaneously active.

The Future

More digital hamsats are on the way. Some are based on the microsat bus, like UNAMSAT from Mexico, while others are being designed around the UoSAT structure. Data rates are expected to increase to 38.4 kbps and beyond, and higher frequencies will be more common. Digital compression techniques and immense satellite on-board memories will allow larger files and even digital full-motion video experiments. PACSAT was only an idea in the early 1980s. Today it has many forms and has become the dominant low-earth-orbit hamsat. Commercial and government interest in small digital-ready satellites has expanded dramatically since the launch of the microsats in early 1990. This has caused competition for "leftover" space on launchers, but can also be seen as recognition for a pioneering effort that was begun in the amateur-radio community.

Number 14 on your Feedback card

CARR'S CORNER

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Dumping AM BCB Interference

The AM broadcast band (AM BCB) runs from 540 kHz to 1700 kHz. (You read right: The FCC raised the upper limit from 1600 to 1700 kHz not long ago.) Most stations are local, and relatively low-power. A few stations are large regionals or clear-channel 50,000 watt blowtorches. Because AM BCB stations are largely local there are lots of them, so it's a pretty safe bet that many, perhaps most, ham operators are close to at least one station. When I was a recent graduate from Novice ranks, a friend of mine, the late Johnnie H. Thorne K4NFU, lived across the street from WARL in Arlington, Virginia. The station operated with 1,000 watts on 780 kHz. The fifth harmonic of 780 kHz landed right in the middle of the 75 meter phone band. So what?

If you are any distance at all from an AM BCB, there is practically zero chance that a fifth harmonic will be found. Right? After all, AM BCB stations are regulated a lot heavier than ham stations. While we need to keep our harmonics -40 dB down from the carrier, AM BCB stations are typically -60 dB down, or more. One AM BCB engineer showed me spectrum analyzer reports from a consulting engineering firm that showed the second harmonic down -85 dB from the carrier, and the higher order harmonics even lower. So what's the big deal?

Well, it seems that any time a strong RF signal of any frequency is present at the input of a radio receiver, it is possible for the signal to bust through whatever front-end tuning or bandpass filtering exists to overbias the input device (transistor, IC, tube), and cause it to go nonlinear. In this condition, a harmonic-free signal from the AM BCB station will *generate harmonics in the receiver.* K4NFU's station receiver at the time was a late 1950s vintage Hammarlund HQ-110 which, by all reports, was at least a decent receiver, if not spectacularly so. But when the receiver was located only 100 yards from the WARL antenna, it overloaded and produced harmonics well past the 40 meter band. The solution to the problem is to put either an AM BCB high-pass filter in line with the antenna, or to put a specific frequency parallel resonant wavetrap (tuned to the offending station's frequency) in line with the signal line. Alternatively, a series-resonant trap across the signal line could be used. In either case, the offending signal is attenuated seriously.

AM BCB Wavetraps

Two simple wavetraps are shown in Figure 1, while a "universal" printed circuit board for these circuits is found in Figure 2. (These Universal Wavetrap boards are available for $4 plus $1.50 S & H per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.) The circuit in Figure 1A is parallel resonant, so is placed in series with the signal line between input (J1) and output (J2). This is done because a parallel resonant circuit has a high impedance to its resonant frequency, and a low impedance to all frequencies removed from the resonant frequency by more than a little bit. Thus, your HF ham band signal will pass through with little attenuation, while the offending AM BCB signal is blocked.

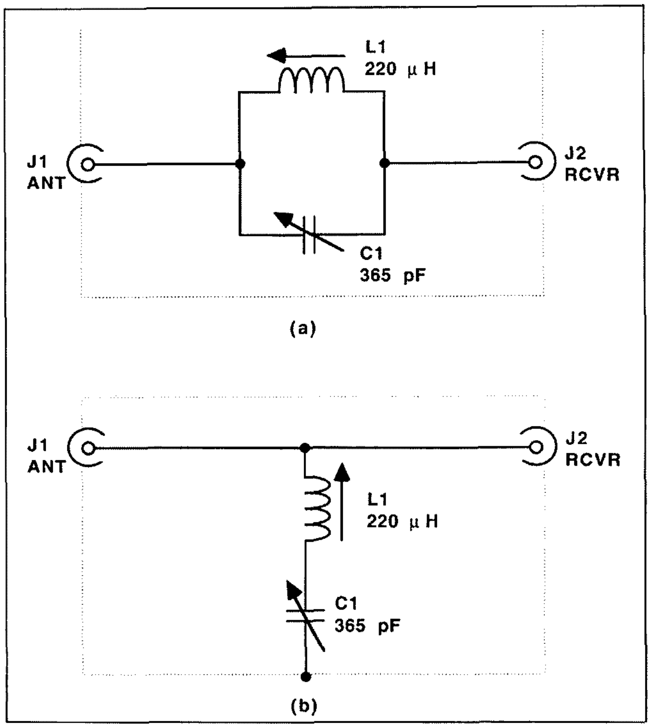

Figure 1. A) Parallel-tuned wavetrap. B) Series-tuned wavetrap.

The version in Figure 1B is series resonant, so it is placed in parallel with the signal line. Series resonant signals have a low impedance to the resonant frequency, and a high impedance to frequencies removed from resonance.

In both cases, we use a 220 µH slug-tuned coil and a 14-365 pF variable capacitor. The capacitor can be a standard single-section "broadcast variable." These capacitors are a little hard to find in the USA (although not in England), but Ocean State Electronics [POB 1458, 6 Industrial Drive, Westerly RI 02891; (401) 596-3080 (voice), (401) 596-3590 (FAX) or (800) 866-6626 (orders only)] has several offerings in their catalog. Order No. BC-14400; it is a 14-365 pF model.

The printed circuit board can be used either with the off-board broadcast variable capacitor, or with a trimmer capacitor and as many disk ceramic capacitors as needed to achieve the required capacitance. If you elect to use on-board capacitors, then note that C1A is a trimmer capacitor, while C1B, C1C and C1D are as many fixed disk ceramic capacitors as are needed to make the correct capacitance. The capacitors selected are the SG-series from Digi-Key (POB 677, Thief River Falls MN 56701-0677; (800) 344-4539). The SG-3014 is a 10-180 pF trimmer. In most cases, not all capacitor slots on the board will be needed.

The inductor on the printed circuit board could be a toroid inductor, al-

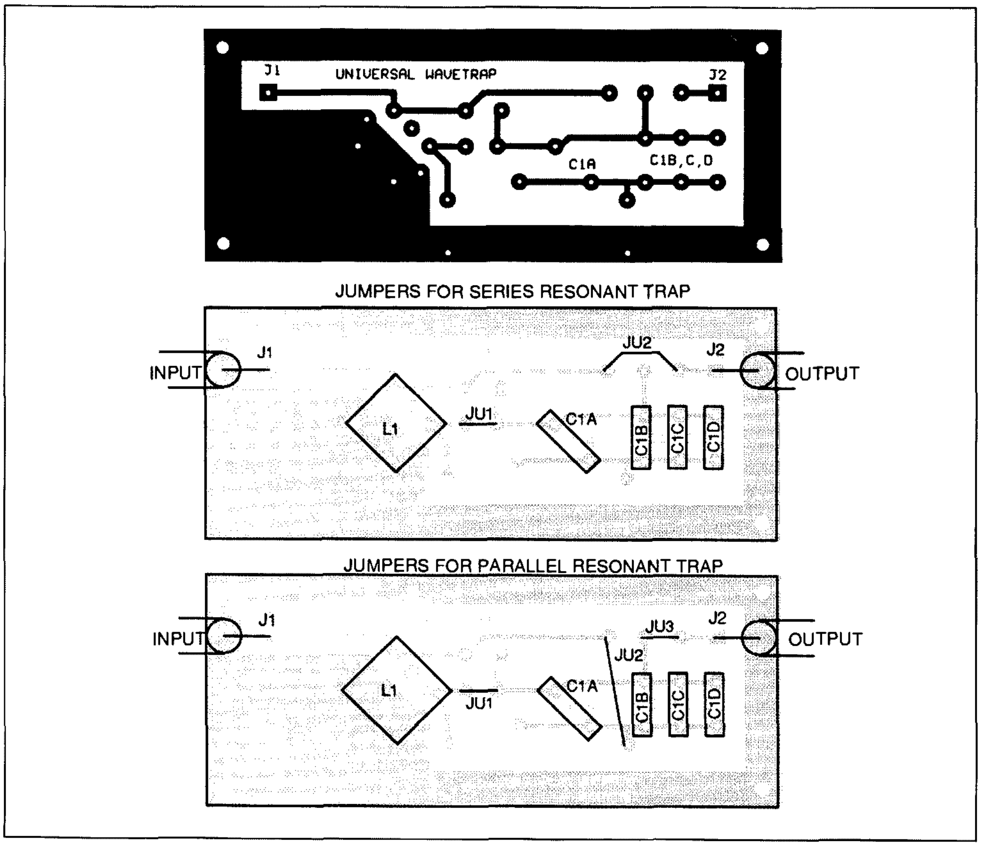

Figure 2. A) Printed circuit layout for Universal Wavetrap; B) jumpers for series resonant trap; C) jumpers for parallel resonant trap.

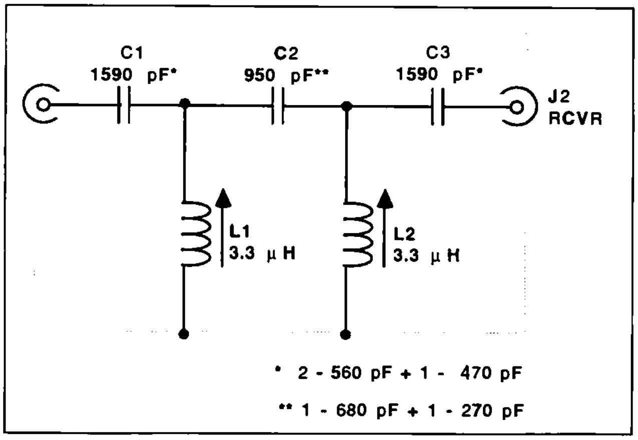

Figure 3. High-pass filter (1,900 kHz) for AM BCB suppression.

though the number of turns may prove excessive for some of us to wind. The particular pattern, however, is for a Toko-brand slug-tuned coil. In the Digi-Key catalog, these are the 10 mm size coils (e.g. 10EZ, 10EZC, 10EZH, etc.). For example a Digi-Key cat. no. TK-1223 is a 220 µH type 10EZ coil.

High-Pass Filter Approach

The alternate approach is to use a high-pass filter between the antenna and the receiver antenna terminals. The filter should be as close as possible to the receiver antenna terminals. In a transceiver, the filter may have to be inside the rig's case unless, you have one that permits a separate receive antenna.

The circuit for the basic filter is shown in Figure 3; the printed circuit board in Figure 4. The capacitor slots on the printed circuit board are designed for a variety of different types of capacitor: disk ceramic, silver mica, polyethylene, and other forms. That's why there are four sets of holes each for C1, C2 and C3. In most cases, you will have to mix and match the capacitors to make the desired values. The 1590 pF capacitors (C1 and C3) are made from two 560 pF and one 470 pF capacitor; C3 (950 pF) is made from one 680 pF and one 270 pF capacitor. The inductors could easily be toroid inductors. A T-37-15 (RED/WHT) toroid requires about 19 turns of enameled wire to make the required inductance. As before, however, the printed circuit holes are designed for a shielded Toko coil (e.g. Digi-Key TK-1414). Builders can buy the Universal High-Pass Receiver Filter boards for $4.50 plus $1.50 S & H per order from FAR Circuits (see address above).

The components for the filler in Figure 3 are intended for a cutoff frequency of about 1.9 MHz, which means that signals in the AM BCB are attenuated. However, the printed circuit board and basic design can be used for any cutoff frequency desired from VLF to VHF. Just calculate the values for the frequency you want to use as a cutoff.

The component values for the filter were calculated using the "ANTLERS for Windows" software. This software package is designed to calculate antenna lengths, but has a "Tuning Circuits" function in which one of the menu items is "Filters." Both high-pass and low-pass cases are covered. "ANTLERS" can be used to calculate the values for filters up to 30 MHz, in case you want to make one other than 1.9 MHz.

"ANTLERS for Windows" Software

"ANTLERS" has the following functions: HF antennas (3–30 MHz), VLF-MW loop antennas (10–7,500 kHz), low frequency antennas (500–7,500 kHz), VHF/UHF antennas (30–2,000 MHz), and Tuning Networks (10 kHz–30 MHz).

Antennas covered in the HF function include: half-wavelength standard dipole, folded dipole, inverted-vee dipole, G5RV, off-center-fed doublet (OCFD), Windom, double-extended Zepp, Franklin array, Lazy-H, one-wavelength loop, half-delta loop, two-wavelength bi-square loop, quarter wavelength verticals, half-wavelength verticals, five-eighth wavelength verticals, three-element yagi beam, two-element quad, phased vertical array, bobtail curtain, and Thorne array. The lengths of the elements and any matching sections are included.

In the loop antenna function, the program calculates inductance of a loop of "A" side length and "B" depth, as well as the capacitance needed to resonate the loop to a specific frequency. Square, triangle, octagonal and hexagonal loop shapes are covered.

The low-frequency antennas function works to 7,500 kHz, so it is useful to hams on 160m, 75/80m and 40m. It includes the simple dipole, the inductively-loaded dipole (two cases: inductors at the feed point and inductors in the center of each element), the twin-lead tee antenna (TLTA), and the loaded discone (or "dippy discone," as some call it).

In the VHF/UHF function, the program calculates the element lengths and matching section lengths (if used) for all three dipoles also used in the HF region (see above), quarter wavelength verticals, 5/8 wavelength verticals, three-element and six-element yagis, and two-element and three-element quads.

In the tuning networks function, "ANTLERS for Windows" calculates the number of turns needed to achieve a desired inductance on a toroid coil form, the resonance of an LC circuit (when C is known or when L is known), and filters (LPF and HPF cases). It will also calculate the component values for antenna tuning units, or impedance matching networks if you prefer, such as inverted-L section, L-section, reverse-L section, pi-network and the split-capacitor network.

In all cases, information is available for the specific type of antenna being calculated. The program uses scroll bars to input data such as frequency, inductance, and so forth (as needed).

"ANTLERS for Windows 2.00" can be obtained from me for $30 postpaid at P.O. Box 1099, Falls Church VA 22041. 73

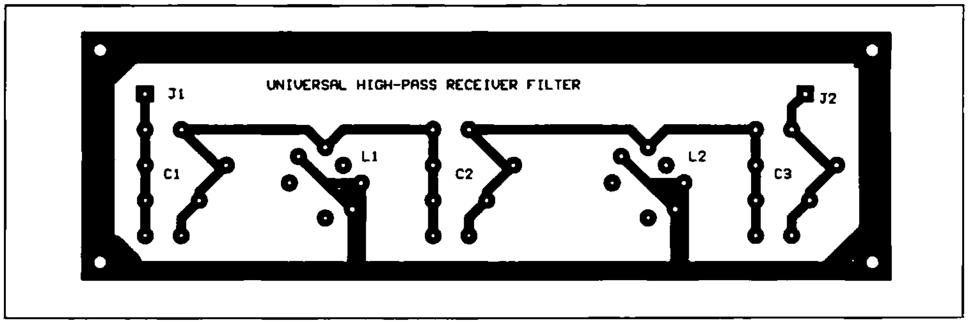

Figure 4. Printed circuit board for Universal High-Pass Receive Filter.

Number 15 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
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Staten Island NY 10313-0006

Up! Up! And Away!

When the invitation first arrived to attend the launch of the space shuttle *Endeavour's* mission STS-59, I was, of course, ecstatic for the entire first week of April. There are few things in life that are quite so exciting as watching the 122-foot-long orbiter lift off like a rocket, orbit like a spacecraft and return to earth on a landing strip like a glider.

This invitation from Mission Specialist Jay Apt N5QWL was especially exciting because I was able to bring guests with me. After my own two children nose-dived across the room at me for the invitations, I decided to make this into an incredible opportunity for some lucky student in my ham radio program.

I ran a contest for my sixth-, seventh- and eighth-graders. They were asked to write an essay, describing why they should be chosen to attend the launch. Hundreds of children put their feelings about the Space Program down on paper. They were all wonderful. It was great to see such enthusiasm. Usually, when someone mentions that they've visited a special place near Orlando, the other kids assume it must have been Disney World.

One of my eighth-grade young ladies, Renée Hoehn KB2QMR, was chosen to go. Renée participated in last year's Ocean Challenge and has spoken to several of the astronauts on the CQ All Schools Net during the past two years. She has expressed a keen interest in all the space projects I do with the children. Renée is considering becoming an astronaut.

Both Renée and her mother Ellen were in constant touch with me as the big day grew near. The entire school got involved with our trip. Children who aren't even in my program were stopping by to ask questions about the *Endeavour's* mission. So much interest and enthusiasm was generated that it really became a school-wide event. Long computer banners were hung in the hallways, wishing us a good trip. Renée became somewhat of a local celebrity, and her eagerness was contagious. She was only too happy to share her expectations with the ham radio operators she spoke with on our school radio station.

The Launch

On April 6th we left for Florida with the best wishes of the student body and staff of Intermediate School 72 in Staten Island, NY. Everyone really seemed to be proud that two representatives of our school would be there in person to witness this spectacular event.

The *Endeavour* had its share of setbacks getting launched. On Friday, April 8, we were up at 3:30 a.m. to enjoy breakfast together and to get over to the Kennedy Space Center to see the sun come up over the shuttle on the launch pad. It was positively awe-inspiring.

It was so incredible to be part of the group of onlookers with cameras and binoculars poised and ready for the big moment. There was definitely something surrealistic about the early-morning scene. We even got to meet some media people from Germany that day who were making a documentary movie. NASA and the space agencies of Italy and Germany provided the $366 million radar equipment aboard *Endeavour.*

The sky, however was definitely overcast that day. "Everything in every direction . . . is solid overcast," Robert "Hoot" Gibson reported from a weather airplane more than an hour after *Endeavour* was to have taken off. The clouds parted slightly later, but as they did, dangerous winds kicked up across a nearby runway where the shuttle would try to land in case of an emergency shortly after liftoff. "It would appear we've traded one vagary for another," launch commentator George Diller said at the Kennedy Space Center.

Photo A. Left to right: Renee KB2QMR, Mrs. Hoehn, Carole WB2MGP, and Lori KA2TCC (Carole's daughter), early in the morning at the launch site.

We listened carefully to the live broadcasts over the speaker system at the viewing site. They spoke about the backgrounds of the six astronauts on board. We listened especially attentively to the plug for amateur radio when they spoke about Dr. Jay Apt N5QWL and Dr. Linda Godwin N5RAX. Jay is the Mission Specialist. He is the Commander of the Blue Shift and will operate the shuttle systems during the "night" shift, while Linda, who is the Payload Commander, is responsible for overall operation of three large radars in the shuttle's cargo bay during the "day" shift.

The secondary payload is Shuttle Amateur Radio Experiment, or SAREX. Nine different schools have been selected to participate in SAREX for this mission.

Saturday morning, April 9, at 7:05, all conditions were perfect for liftoff. Renée's mom said that the shuttle seemed to "glow magnificently as it lifted off into the sunrise. As the final rocket boosters separated and fell into the water, they looked like falling stars." For days afterwards both Renée and her mother said that viewing the liftoff of the *Endeavour* was "the experience of a lifetime."

When we returned to school everyone was eager to hear about what we had seen. I commandeered Renée to speak to several of my ham radio classes. I smiled to myself as she described the sounds and feelings of the moment of liftoff. All the children wanted to know what it sounded like. Renée described it as being like "millions of firecrackers going off at the same time."

One of the many nice things about being a teacher at a time like this is that an incredible, out of the ordinary, experience such as witnessing a shuttle launch can be shared with so many children. It adds a new meaning to "show and tell."

Number 16 on your Feedback card

Low Power Operation

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More Modifications

If the DX is not running and the bands seem dead, what do you do? Well, you could do like Scott N8JSK does and raise aphids, or you could heat up the soldering iron and make some modifications to your equipment.

This month I've got several modifications for you. The first deals with the very popular MFJ QRP rigs.

MFJ QRP Rigs

The first production run of these nifty little rigs suffered from low audio gain. The poky LM386 audio power amplifier was again pressed into use. In the MFJ 9020, the LM386 is supplied with its operating voltage from the rig's main voltage regulator. In the case of the 9020, the regulator is an LM317. The output of the regulator is set for 10.5 volts. This is the voltage the rig runs on, with the exception of the final RF output transistor. Since the audio amplifier is also being powered by the 10.5 volt VCC, its output runs lower than usual. The fix is simple. All you have to do is rewire the VCC run so the LM386 is supplied by the unregulated side of the LM317. The extra 2 volts or so really makes an improvement in gain.

Don't try to adjust the LM317 for a higher output—you'll screw up some of the other circuits that require the 10.5 VCC. Also, since the LM317 requires at least 2 volts over the regulated output, you'll lose regulation of the VCC line. Figure 1 shows how simple this is to do: Cut a trace on the PC board and run one wire. That's all there is to it.

MFJ made this modification to later production runs of the rigs. If you're not sure if yours has the modification, check pin #6 of the LM386 with your VOM. If the VOM says 10.5 volts, then the modification has not been done. If the VOM reads the supply voltage, say 13 volts, then the modification is factory-installed.

New Front End

Although you can't really call this a modification, the circuits shown in Figure 2 may improve the performance of your receiver. The values are for the 40 meter band. The circuit at the top seems to work the best for me. I'd recommend it over the other one, but that, too, works quite well. Use the cores specified in the schematic. The variable capacitors are Arco trimmers. I used hamfest junk box units in my project.

For transceiver operation, you must break the connection between the receiver and the transmitter. Insert the filter in the receiver's antenna line only. If your transceiver has diode switching, with a pick-off from the transmitter's output filters, you may have to play with the values of the filter's components. I find this circuit really keeps the unwanted critters out of my direct conversion receiver.

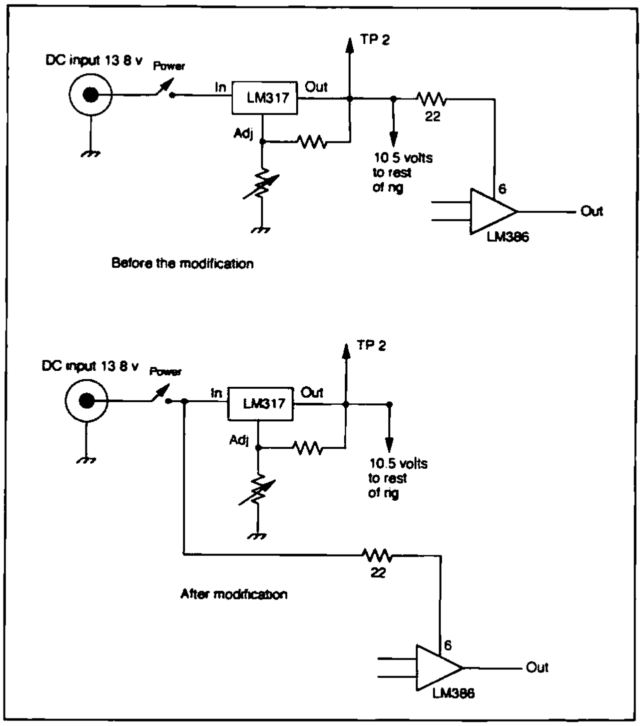

Figure 1. Modification to correct low audio gain in some MFJ QRP Rigs.

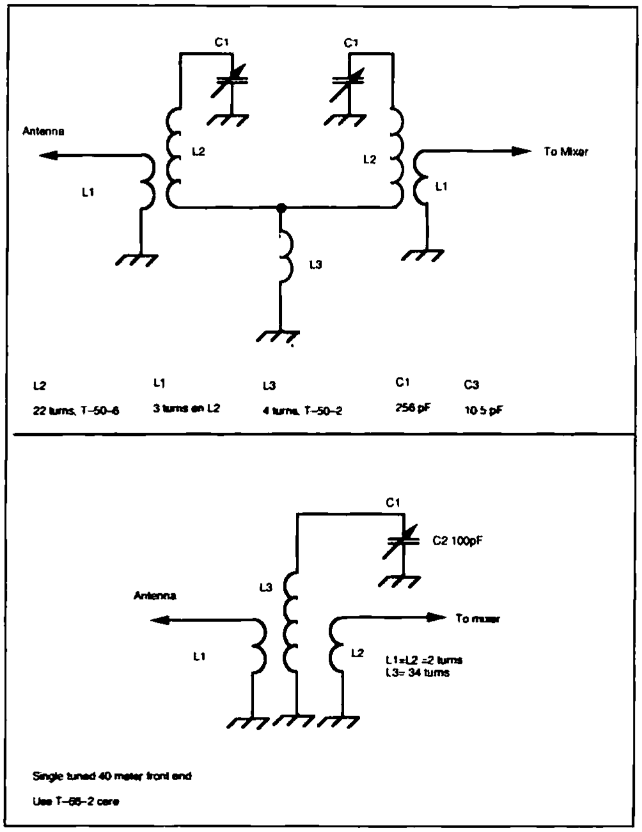

Figure 2. Two circuits that might be able to improve your receiver's front end. Values shown are for 40 meters.

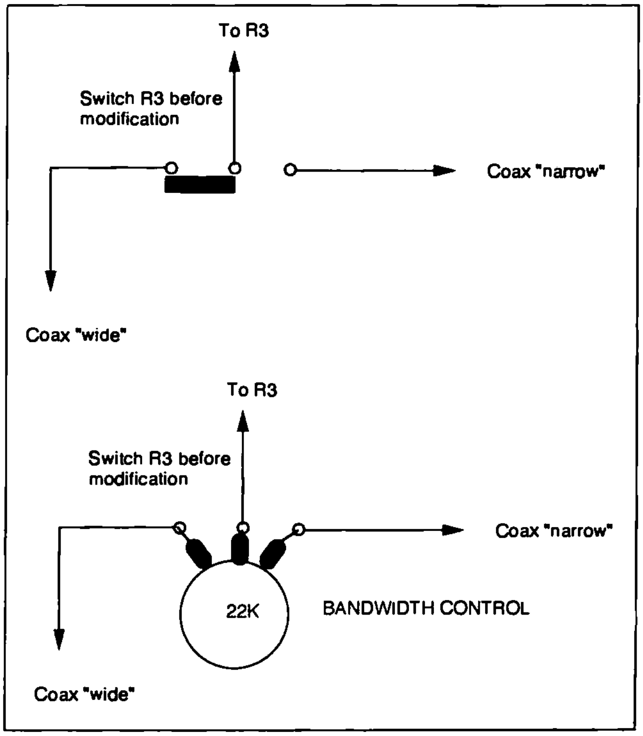

Figure 3. A modification for your Heath HW-9 which will replace the selectivity switch with a pot.

Although I don't have one in my shack, i wonder if either of these filters would make the Heath HW-7 receiver worth using? Again, you would have to break the connections between the transmitter and the receiver. This will require cutting some PC board traces. Don't try it if you're not up to this type of modification.

No matter how you use these filters, they will work best if you install them in some sort of shielded box. I use double-sided PC board for my boxes. But, the stuff is really hard to get into if you solder all the way around the edges.

or may not like the results.

The second modification turns the S-meter into an expanded voltmeter so you can track battery voltage. This is a great idea if you're working on battery power in the outback. This circuit is also from Germany. The schematic for this modification is shown in Figure 4. Notice the values of the resistors. The values listed are only a guide; you will need to change the values to suit your HW-9. Seems Heath did not use the same meter in all production runs.

A double-pole double-throw switch selects between S-meter and voltmeter. The entire circuit can be built on a small hunk of perf board. A PC board could also be drawn out, too. Notice the use of the meter scale. This way, you don't have to recalibrate the meter and you don't have to rework the meter's face. Take a look at Figure 4. You'll see what I mean by using the meter's face to read voltage. Nope, it's not a Fluke 77, but it's better than nothing. And, you don't have to carry another piece of gear with you when you travel.

Since I have sold my HW-9, I can't say if either of these modifications work. Proceed on your own with caution!

"No matter how you use these filters, they will work best if you install them in some sort of shielded box."

A multi-pole switch could be used to select the proper front-end filter for several different bands. All the filters would need to be shielded from each other in one box. Again, double-sided PC board is great for this.

HW-9 Mods

Here are two more modifications for the Heath HW-9 QRP transceiver. The first one is rather simple and I've seen this same modification done to the HW-8. It requires removing the selectivity switch and replacing it with a pot. In this case, the switch is replaced with a 22k pot. Since this modification came from DL7GK in Germany, I'd say you could get by with a standard 20k pot and have the same effect as with a 22k pot. By using a miniature pot, you might be able to squeeze it to fit on the front panel. The circuit is shown in Figure 3. It's about as simple as they come. You may want to hard-wire this modification in and give it a try before you drill any holes in the HW-9. You may

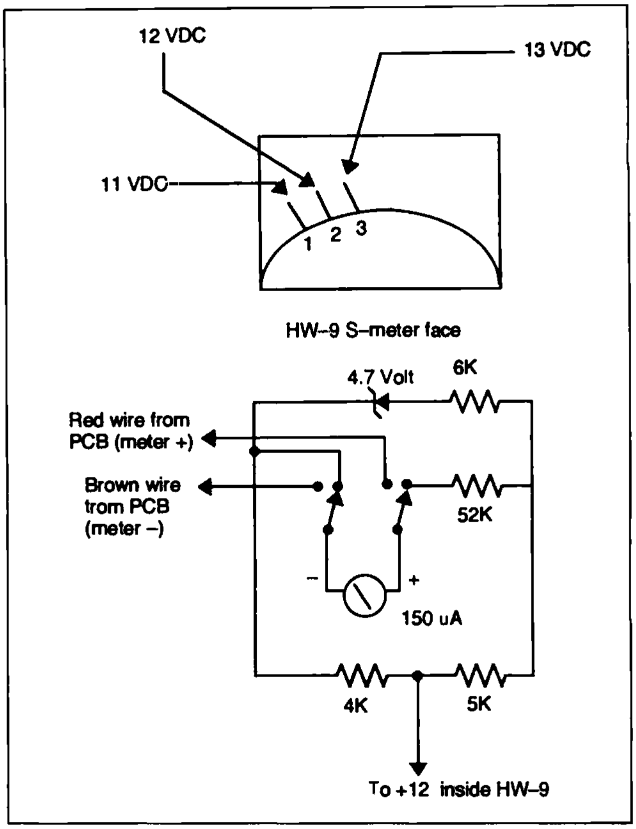

Figure 4. Schematic for modifying the Heath HW-9, turning the S-meter into an expanded voltmeter so you can track battery condition.

Longer Columns

Thanks in part to my new toy, an Apple Powerbook, I've been able to expand on some of these columns. Having the computer with me at work has allowed the column to grow a bit. Since I work in a factory, the extra time between setups has proved very useful. That's why I've been able to make these columns longer.

Damn, It's Cold!

It's cold up here in the middle bay crane! Yup! This is January 19 and it's the coldest day on record. As I work on this column, all the major electricity suppliers have asked heavy industry to reduce their electrical demands. In fact, our factory has been ordered to shut down so the energy can be used for residential customers. In some parts of West Virginia, there have been rolling blackouts for up to one hour.

If you happen to enjoy running QRP, you'll never notice the blackouts! Why, an HW-9 or a MFJ 9020 and a battery will keep you on the air for a very, very long time. That's especially true if you don't smoke cigars!

Number 17 on your Feedback card

PACKET & COMPUTERS

Digital Amateur Radio

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OK, I'm back after a month's absence. The column tried to compete with moving and lost. Moving is one of my least favorite activities, and this one was worse than expected. On the other hand, we're here and things are smoothing out.

This month I have a few things to deal with, so I will not be doing a "regular" installment of the TCP/IP series. Instead, I need to cover some "administrative" information, and I'll also discuss some IP odds and ends that should be interesting.

First, the administrative. Many of you write to me, both on paper and via the bit stream. I really appreciate hearing from you, and read everything. Replying can be somewhat more difficult. I am not ignoring you. First, I get Email from my other writing work as well, and the combination of *73* mail (you guys aren't shy), and other traffic can be overwhelming at times. I really appreciate all of the feedback—praise and not-praise—but I just don't have a good way to reply to everyone.

Second, many of you have written asking for reprints and executables. I cannot provide these. Reprints come from *73*—call (603) 924-0058 to obtain these; reprints are $3 per article, back issues are $4 each. For the executables, I do not have the time to copy and mail diskettes. Many of you have sent prepaid diskette mailers and disks. I have not been able to do anything with these. You can get any executable or text file I describe on the *73* BBS at (603) 924-9343, 300-2400 baud, 8 data bits, no parity, one stop bit.

Now wait a minute—I know that many of you have tried to find these files on the BBS and they just haven't been there. I must take the blame for this, but I will be changing it.

Now, a personal note to an unknown reader: If you sent me some cash, please write again and let me know who you are. You can identify yourself by telling how much you sent and why. Some time ago, a bunch of mail that Included a collection of checks, diskettes, and mailers got separated from the letters that went with them. I do not cash checks sent to me, and I want to return your money.

OK—Here's the last bit of administrative nonsense: how (and how *not*) to contact me. I can be reached three ways:

1. Email on the Internet: This is the preferred method of contacting me and stands the best chance of getting a response. Those of you who subscribe to online services like CompuServe, Genie, AOL, Prodigy, BIX, Delphi, and the like can all reach me at this address. The exact method can vary considerably—get help on your system in addressing mail to the Internet. My Internet address is: jsloman@bix.com.

2. Paper Mail: This is an acceptable way of contacting me if you do not have access to electronic mail (you should, you know). Please write to me c/o *73* magazine, at the address listed above.

3. Packet Mail: Of course I want to hear from you via packet! *But, I cannot answer questions about the column or magazine this way.* Too many of you write to me via packet radio and ask things that, were I to answer, would constitute doing business on the radio. This is *very* frustrating: You have good questions. I am *not* ignoring you, I just *can't* answer—sorry. Please send me packet traffic for fun, to try it, to let me know that you've got something working. But if you want me to respond, don't mention the magazine, *please.* So, with that preamble, address your packet traffic to me at:

N1EWO@NØARY.#NOCAL.CA.USA.NOAM

(Note the NOAM at the end—for North America. Do not use NA, the people in Namibia are not too happy with the folks that do.)

On to other business. First, let me tell you about the latest, and last DOS version of JNOS: 1.10c. WG7J has announced that he is now concentrating on developing a WIN32 version of JNOS (a very good thing indeed), and so 1.10c is the last version that he will release for DOS. Where can you get it? Well, as of this writing you *cannot* get it on the *73* BBS. You *can* get it via anonymous FTP from several of the ham archives. I will avoid specifying a site—this has gotten me in trouble in the past. You should be able to get it from places like CompuServe as well, but I can't guarantee that. JNOS is very widely distributed; ask around.

Version 1.10c adds several features which will be completely new to those of you who are using non-release (x) .10 versions. First, there is a very useful status bar which displays using the top three lines of the display. It offers some nice at-a-glance info:

On the first line—time memory status number of sessions using the various servers (conv, links, bbs, fwd, ftp, smtp), a list of active terminal sessions, specified by number; these blink when there is text waiting in a session not currently displayed.

On the second line is a list of current BBS users by callsign. Each callsign is preceded by a character indicating which activity the user is engaged in.

On the third line is information about the currently-displayed session, including the connection and information about retry timers.

(Users of WNOS are already familiar with this type of status display. This excellent feature is now available to JNOS users.) The status display is configurable in two ways: color and number of lines. The specific colors of the text and background of each line are configurable. You can also choose to display one, two or three lines of status information. Speaking of color, the text display colors are now configurable at startup as well. This is very useful because of another new feature—a command line in the trace window.

You can now execute commands directly in the trace window. This is very useful, for example, when testing using ping. You can ping a station and see the interaction from the very beginning. No more attempts at lightning-fast switches to the trace window with the F9 key are necessary.

There are many other features you will find useful in this new and last version. Get a copy and give it a try—tests here show it being very stable.

TCP/IP Routing Using Digipeaters

You and a friend want to communicate using JNOS on each end; the trouble is, you need to use a digi to make the connection, a digi that doesn't know anything about TCP/IP. Hmmm, how can you make the connection?

The impossibility of using a plain-old-digi for TCP/IP is only a misunderstanding of how the system operates on amateur radio. TCP/IP over ham radio has two different layers. There is a logical layer that handles TCP/IP messages and traffic, and then there is a hardware layer. It is in this hardware layer that the digipeater lives.

When you attempt to connect to a friend's station which *can* hear you directly, the first thing your station will do is to send an ARP request over the default interface. ARP means Address Resolution Protocol, and is the way the an IP station finds out the hardware address associated with the IP address which it has been told. Let's see how this works:

You type "telnet 44.48.70.22" at the JNOS command prompt. JNOS responds by opening a new session window. At the top of the window is the message "Resolving 44.48.70.22." JNOS has just transmitted and ARP request. This is a broadcast message saying, "I need to know the hardware address associated with the IP address 44.48.70.22."

Your friend's station recognizes its address and responds, saying that N1EWO handles IP traffic for 44.48.70.22. Your station places this information in your ARP table, and establishes the connection.

This is the way that it should work, if stations can hear each other. But what if they cannot? In this case we can't rely upon the automatic ARP process, and instead have to make it happen manually. To do this we'll need to make our own arp entries, and also add AX.25 routing information. ARP entries are soft; that is; they will go away when you restart JNOS. To make them "permanent," put them in the AUTOEXEC.NOS.

Here are the facts about the station we wish to reach:

IP address: 44.48.70.22 hardware
address: N1EWO
(note that hardware address=AX.25 address)
digipeater: KB9BWE

So first let's make the ARP entry so that the station does not have to generate an ARP request which could not be answered. We do this from the command line, using:

arp add 44.48.70.22 ax25 n1ewo dsp

arp	the ARP command for JNOS
add	tells JNOS to add the following information to the ARP table
44.48.70.22	the host ID of the station for the entry (this could be alphanumeric [e.g.: N1EWO] if you have the appropriate entry in your DOMAIN.TXT file)
ax25	tells JNOS to use the ax25 hardware layer
n1ewo	the hardware address of the station for this entry
dsp	the name of the interface that should be used for this entry

Now, when you attempt to connect to 44.48.70.22, this ARP entry will be used. So, we're halfway to the solution—JNOS will now use the correct hardware address for N1EWO. What about the digi?

JNOS also maintains a routing list for AX.25 traffic. Using a very similar technique, we add the information about KB9BWE—our digi—to the AX.25 table. From the JNOS command prompt:

ax25 route add n1ewo dsp kb9bwe

ax25	the JNOS AX.25 command
route	the route sub-command
add	tells JNOS to add the following information to the AX.25 route table
dsp	the name of the interface to use
kb9bwe	the name of the digi (more than one can be specified)

Now, JNOS knows everything it needs to about how to reach 44.48.70.22 from your station. When you "telnet 44.48.70.22" it finds the hardware address already in its ARP table and the AX.25 route table tells it to use a digi to get there.

More next month. 'Til then 73 de N1EWO.

HOMING IN

Number 18 on your Feedback card

Radio Direction Finding

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Attenuators Made Easy

Carefully planned deception can make the difference between a simple hidden transmitter hunt and a real challenge. Just as a football team relies on deception to foil the opponent's defense, hiders in radio direction finding (RDF) contests (called foxhunts or T-hunts) do their best to cause hunters to make incorrect assumptions about direction and distance to their location.

Last April's Fullerton Radio Club mobile hunt is a good example. WA6OPS and I helped WB6GCT and WB6UZZ hide it. At the starting point, our signal was from the north and was quite weak. S-meter readings were about the same with the hunters' yagis and quads set to either horizontal or vertical polarization.

Figuring that the T was near the distant boundaries, some teams bolted for the freeway to head north. Others, suspecting that we were reflecting our signal from the front range of the mountains 25 miles away, headed east or west on a hunch. All 15 teams lost the signal upon leaving the starting hill, but they kept going.

All had been deceived. Our T was only three miles north of the start, on the side of a hill that blocked the signal toward the freeway. A paltry 2.5 microwatts drove an 11-element beam pointed toward the start. It was two hours later that the first team found the transmitter. The six teams that managed to find it that night had driven from 22 to 52 miles. They were fooled by the carefully-controlled power level and antenna position.

Our fox transmitter put out such a meager signal that a hunter could drive from the start point to within 100 feet of its antenna without the S-meter ever registering full-scale. That's very unusual, since the 5 to 50 watt hidden transmitters encountered on most mobile hunts usually pin hunters' signal indicators when they are several miles away. Typical VHF-FM receiver S-meters have only a 20 to 30 dB range.

Antidotes for Overload

Every T-hunter who gets bearings with a directional antenna and S-meter requires some method for knocking down strong signals to the point that amplitude changes can be discerned. But RF gain controls are provided in only a few VHF transceivers, usually the relatively expensive multimode models. If you are thinking of purchasing such a rig just to have RF gain control for T-hunting, be sure to test it before you buy. In many cases, lowering the RF gain control adversely affects S-meter action. You may not be able to take bearings with gain reduced.

If you enjoy performing minor electronic surgery inside receivers, you can add internal RF gain reduction that won't upset S-meter action. Control the supply voltage to the RF preamp and first mixer stages, or change the bias of the FETs in these stages. The "Homing In" column in the March 1989 issue of *73 Amateur Radio Today* provides plans for a voltage-reduction internal attenuation system for popular VHF-FM transceivers.

A simpler and much more popular way to knock strong signals down to size is to connect an attenuator box between your antenna and receiver input. A resistive (sometimes called a "passive") attenuator has several shielded sections, each with resistors to soak up the RF signal and a double-pole double-throw switch to put the section into and out of the line (Photo A).

With the circuit in Figure 1, you can select signal reduction in 5 dB steps from zero to 75 dB. RF leakage across the switch makes attenuation of more than 20 dB per section impractical. If your receiver is especially well-shielded, you can add another 20 dB section to get 95 dB maximum. More than four 20 dB sections are not worth the effort, due to the likelihood of RF coupling around the attenuator and leakage through the receiver case.

This attenuator is an easy and inexpensive construction project. Build the multi-cell enclosure out of double-sided unetched PC board material or sheet copper. Solder the dividers and end caps in place with a continuous bead of solder before mounting the resistors, connectors, and switches.

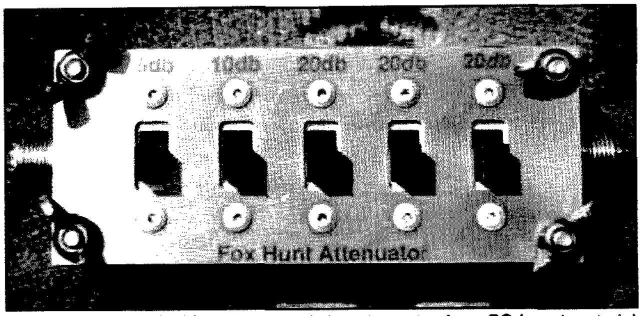

Photo A. You can build your own resistive attenuator from PC board material, switches, and resistors. Or you can buy a finished unit like this from Arrow Antenna. Its copper-clad case measures 2" x 4-3/4" x 1-1/4".

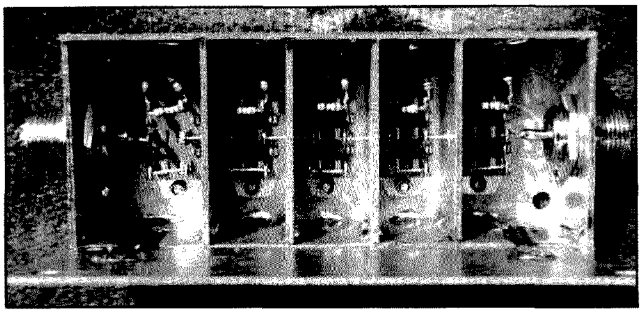

Photo B. Inside view of the Arrow resistive attenuator showing the five shielded cells and two hinges made from copper braid.

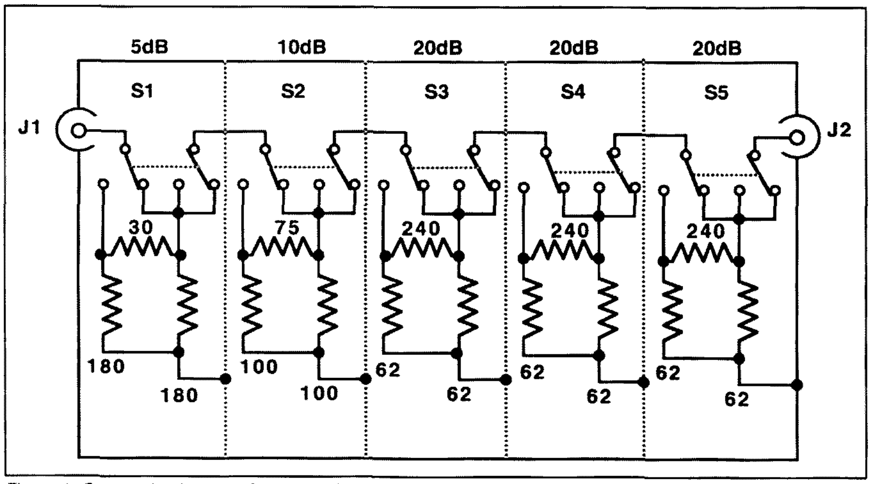

Figure 1. Schematic diagram of a simple five-section resistive attenuator for T-hunting on any ham band from 160 meters through 70 centimeters. Resistor values are in ohms. Switches are shown in down (attenuation out) position.

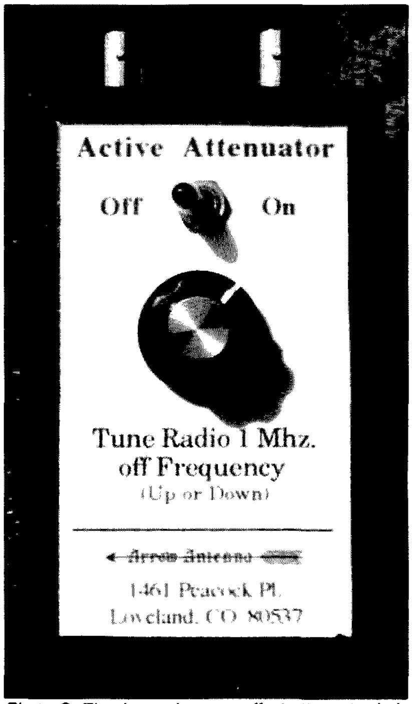

Photo C. The Arrow Antenna offset attenuator is in a 2-3/8" x 3-3/4" x 1" plastic box.

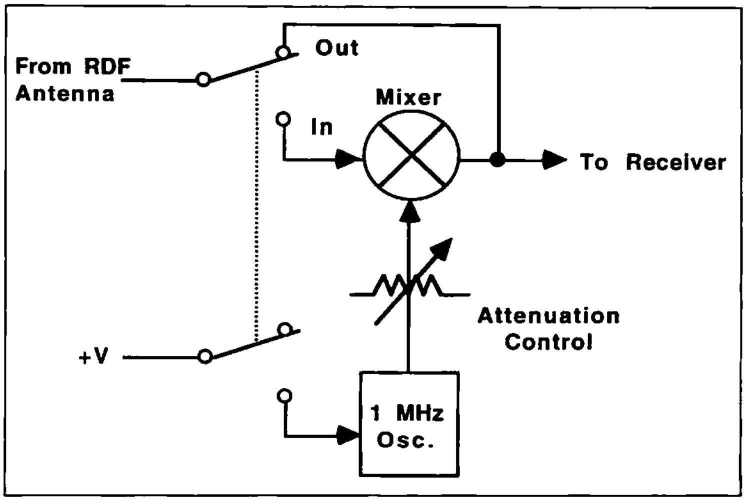

Figure 2. Block diagram of the external offset attenuator.

Do not secure the back cover with a long solder bead, because that will make it difficult to open for repairs. Instead, make hinges out of braid material and install them as shown in Photo B. Bolt the cover closed or fasten it with copper tape. The hinges hold the cover and prevent unwanted leakage and coupling. A hinge in each cell is best.

The resistor values shown in Figure 1 ensure that the receiver and antenna remain terminated with the same impedance as the 50-ohm coax line at all attenuation levels. Use only carbon composition or carbon film resistors for RF attenuators—never wirewound or metal film types.

Quarter-watt resistors are OK, but I prefer half-watt parts. They withstand accidental transmissions for longer periods. It's even better to use 1 or 2 watt resistors, but installing them in the cramped cell space is very difficult. Keep all resistor leads and jumper wires as short as possible. Jumpers between cells are straight insulated wires passing through small holes in the dividers.

Good quality slide switches give better RF performance at VHF than toggle switches, but they require a rectangular hole and are less liquid-proof than toggle switches, which I use. Subminiature or micro-mini size toggle switches fit and work better than miniature types, but they are more fragile. In 18 years of T-hunting use, I have never accidentally burned out any of the half-watt resistors in my home-brew attenuator, but I have replaced several subminiature toggle switches that wore out or were damaged.

Build or Buy?

Commercial resistive attenuators are available, but most are expensive precision units for laboratory measurements. Many do not have enough 20 dB sections for T-hunting. Nevertheless, it is a good idea to watch at swap meets and surplus outlets for suitable ones at bargain prices.

T-hunting enthusiast Allen Lowe NØIMW now sells attenuators as part of his Arrow Antenna line of products. His resistive model has the same configuration as shown in Figure 1. The case is made from Fiberglas PC board material. It uses slide switches with gold contacts and quarter-watt resistors. Bolts and wing nuts hold the rear cover, so it is easy to open for repair. You can choose either UHF (SO-239) or BNC connectors when you order.

I tested the unit in Photo A on the 2 meter band with a well-calibrated signal generator. Performance was typical of T-hunt attenuators. Insertion loss with no attenuation was 2 dB. Each step had accuracy of 1 dB or better. Maximum attenuation with all sections switched in was 71.5 dB.

To Solve Leakage, QSY

Handie-talkies and scanners are notorious for poor case shielding. A passive attenuator cuts down the signal level into the antenna jack, but strong signals will still penetrate the case and pin the S-meter. One way to get bearings on nearby foxes with these sets is to convert the strong on-frequency signal into a weaker off-frequency signal. Then you can tune your receiver to the offset signal and measure its strength versus direction.

Figure 2 is the block diagram of a simple unit for level-controlled frequency conversion. When this scheme was originally described in *QST* magazine, November 1992, by Anjo Eenhoom PAØZR, it was called an active attenuator. Since there are other kinds of attenuators that are also called "active," I prefer to call it an offset attenuator. That term describes how it solves case leakage by offsetting the frequency.

An offset attenuator consists of a local oscillator (LO) connected to a diode mixer through the attenuation control. The higher the LO level, the higher the amplitude of the offset signal applied to the receiver. To increase attenuation, decrease the LO signal into the mixer with the control.

Arrow Antenna's new attenuator line includes an improved version of the PAØZR design (Photo C). Instead of a 500 kHz L-C oscillator, the Arrow unit features a 1 MHz SaRonix crystal clock module, which has higher accuracy and stability. 1 MHz is a good choice for the frequency offset, because it is easy to remember and program into your radio.

The trade-off for improved stability is higher supply current, approximately 35 milliamperes. A three-terminal regulator provides 5 volts to the LO, so performance is stable with battery voltage down to 6.7 volts. A 9-volt alkaline battery should power the unit for at least 12 hours. Arrow does not provide a power-on or battery condition indicator, but there is room to add them if you wish.

The unit I tested was one of the first made by Arrow, and did not include an instruction sheet. No problem—it is very easy to use. Using BNC jumper cables, hook it between your directional antenna and receiver. The connectors are not labeled. With the simple 1N4148 diode mixer in the Arrow unit, it does not matter which port goes to the antenna and which to the receiver.

In my tests on 2 meters, insertion loss of the switched-off unit was 0.3 dB. On-frequency attenuation with power on ranged from 7 to 17.5 dB with adjustment of the attenuation control. Tuning the receiver up 1 MHz gave attenuation of 11.5 to 101 dB over the control range.

The LO module puts out a TTL square wave. Its harmonics, especially odd multiples, are very strong. You can tune up or down in 1 MHz steps and hear the target signal at varying attenuation levels. Unfortunately, this means that the chance of interference from cross-modulation products is much greater than if the oscillator put out a pure sine wave. For example, if you are hunting a T on 147.48 MHz, you will get interference from strong paging transmitters on 152.48 MHz.

Figure 3, which charts my measurements of minimum attenuation at the 10 closest offset frequencies, can help you predict the level of cross-modulation interference and select the best offset frequency to use. Generally speaking, cross-mod is less severe when your offset is an odd multiple away from the desired signal and an even multiple away from the undesired signal. In the example above, the paging transmitter will cause strong QRM to the 149.48 and 151.48 offset signal, but much less interference to 148.48 and 150.48.

Arrow literature says that the unit is

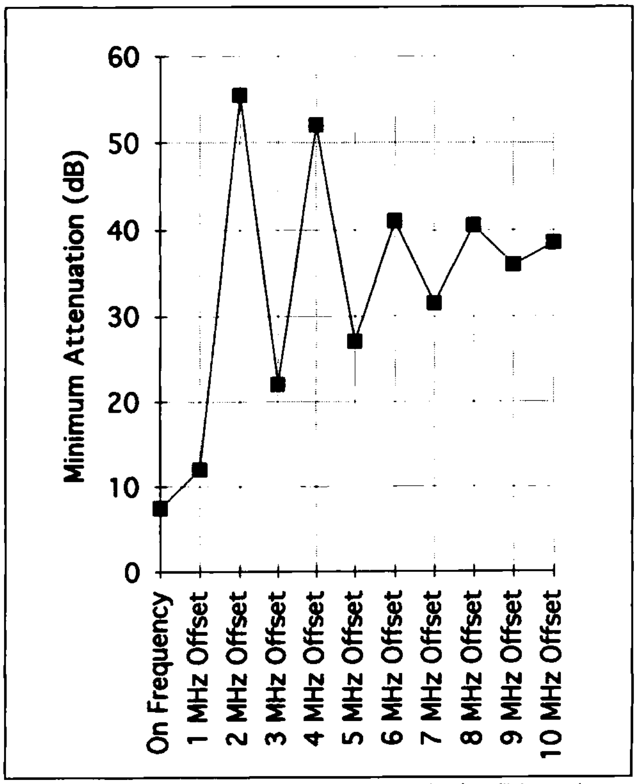

Figure 3. The Arrow offset attenuator's square wave local oscillator produces a multitude of heterodyne signals at 1 MHz intervals with different levels. This chart shows the relative amplitudes at the receiver, with respect to the input signal level. Attenuation control is set to minimum.

not suitable for hunting a fox on an exact 1 MHz multiple (such as 147.000 MHz), due to QRM from harmonics of the oscillator. The harmonics are strongest at minimum attenuation setting. They were full-scale on 2 meters in my mobile setup, and half to three-quarter scale on the 222 and 440 MHz bands. However, with extra care in adjusting the attenuation control, I was still able to get bearings on a strong test signal on 147.000 MHz. LO harmonics are a problem when an even-megahertz fox signal is just strong enough to pin the S-meter, but they will not cause trouble when you get very close to the T and raise the attenuation control setting.

There is no isolation between the mixing diode and your antenna. Offset signals not only go into your receiver, but they also go back to your RDF antenna, where they are radiated. This may cause cross-modulation QRM to nearby receivers, even outside the ham bands.

The Bottom Line

An offset attenuator is excellent for on-foot foxhunting, whether you use it for "sniffing" at the end of a mobile hunt or for European/Asian style in-the-woods radiosports. It works with directional antennas or just with a rubber duckie as an aid to the "body shield" maneuver.

On the other hand, a resistive attenuator is a better choice for mobile RDF, in most cases. Passive attenuators avoid the problems of images and re-radiation that are far more harmful in mobile situations than on foot.

Usually, the only time an offset attenuator is superior to a resistive attenuator in a mobile setup is when you are close to a powerful hidden T and your mobile rig is overloaded with all resistive attenuation steps in. In such a case, connect the offset attenuator between the resistive attenuator and the mobile rig. To minimize re-radiation QRM from your mobile RDF antenna, set the resistive attenuator to 20 dB or more.

Remember that an offset attenuator does not significantly reduce the level of on-frequency signal into your radio, so it does not provide protection for your receiver's front end. If you touch your RDF antenna to the antenna of a powerful fox transmitter, you may damage both the receiver and the offset attenuator.

Avoid transmitting through any external attenuator. You may damage the resistors in a passive unit. You will transmit strong spurious signals if you key up through the offset attenuator, and you may burn out its diode. Disconnect the mike if you are T-hunting with a mobile rig. Set the power output down to the lowest possible level on your hand-held. Fortunately, if you forget and cause a failure, repairs are easy and inexpensive.

Mail-order price of the Arrow offset attenuator is $59. The resistive attenuator sells for $49. For more information on Arrow products, contact Arrow Antenna, 1461 Peacock Place, Loveland, CO 80537; (303) 663-5485. To contact me, write to my California address under the heading. Remember that a self-addressed stamped envelope for the reply is always appreciated.

HAM HELP

Number 19 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I have recently "inherited" a RADIO SHACK TRS-80 Model III with no software, operating system or documentation. My local Radio Shack has been unable to help me. Since I am planning on dedicating the machine to packet, I knew I would be better off relying on my fellow Amateurs. I will gladly reimburse you for your expenses. Thank you. *Johnny P. Brown N1QQS, P.O. Box 1305-226, Brunswick ME 04011.*

I need the schematic for HEATH Company Model SA-5010 Keyer. Your help will be greatly appreciated. *Tom Stepanov RA6AR/WN1R, P.O. Box 555, Sochi-355, Russia 354355.*

WANTED: Manual (tor copy) for ICOM IC-245 2-meter transceiver. I only need the sideband adapter information, or any computer interfacing information. *Claude J. Cook KD6NFJ, 34A Springbrook Rd., Westerly RI 02891.*

ATV

Ham Television

W4HTB Repeater

Hank Cantell W4HTB of Bowling Green, Kentucky, decided to stir up some ATV activity in the region with an ATV repeater. He obtained permission from the local TV station (channel 40) to locate the repeater at their transmitter site about 15 miles north of town (700 feet above average terrain). With his antenna at the 160-foot level, Hank's repeater provides great coverage that includes Glasgow, Kentucky (about 30 miles to the northeast).

Features

The repeater has both in-band and crossband capabilities. The input is on 439.25 MHz with outputs on both 426.25 MHz AM TV as well as 1280 MHz FM TV (5.8 MHz audio).

One of the most unusual features of the repeater is the ability to transmit two different audio channels through the use of both subcarrier and on-carrier sound on the 426.25 MHz output. The subcarrier audio channel relays the normal ATV audio signal while the on-carrier channel listens to the 144.34 MHz FM receiver that's located at the repeater site. Not only does the system work as an ATV repeater but as a crossband FM voice repeater as well!

Touchtone control via the VHF receiver allows the users to turn the 426.25 MHz output off so that the system works solely as a crossband TV repeater to allow link capability with other repeaters. Hank plans to install an additional receiver on 421.25 MHz to allow his repeater to relay the output of the KJ4ZQ ATV repeater in Nashville, Tennessee (50 miles to the south).

Another Touchtone command allows the user to turn on the repeater continuously for DX contacts (essentially links the receiver directly to the transmitter without the need for sync trigger).

Additional commands will turn on the video ID, switch in another video source or a live shack or tower camera.

The Hardware

The repeater is horizontally polarized on the 70 cm band. A stacked set of "Quad Little Wheels" by Olde Antenna Labs is mounted at the 160-foot level of the tower, feeding a 200-foot run of 1" hardline to the equipment room. The signal is split to the receiver and the transmitter using a TX-RX #26-66-01A duplexer.

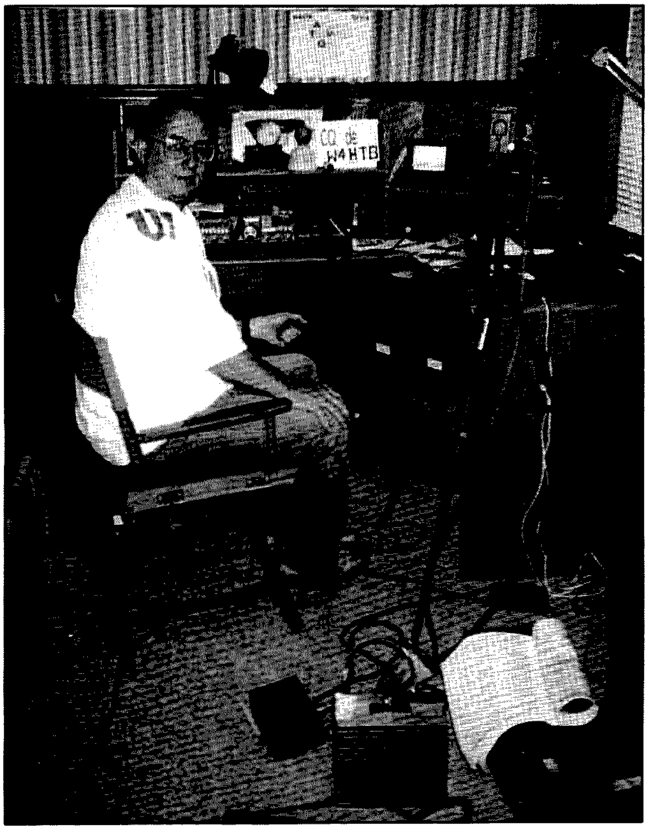

Photo A. Hank Cantrell W4HTB working his ATV repeater from his ham shack in Bowling Green, Kentucky.

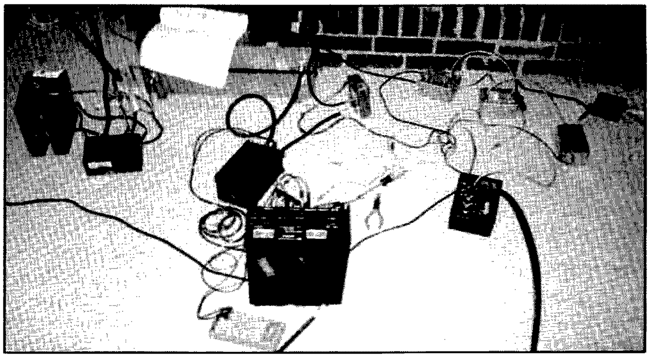

Photo B. The component parts of the W4HTB repeater are assembled in Hank's final test facility.

The receive system consists of a P.C. Electronics ATVR-4 receiver that delivers video to the video switch and sync detector circuit. The video ID and alternate video sources can be routed through the video switch as well (controlled by Touchtone commands via the VHF receiver). In addition, the 426.25 MHz transmitter can be controlled by Touchtones. The video signal from the switcher goes to both the 426.25 MHz AM-TV transmitter and the 1280 MHz FM-TV transmitter. The 426.25 exciter was made by Bestlink and feeds into a Pauldon 18-watt amplifier (PD-440N) and routes back into the duplexer. The 1280 MHz FM-TV transmitter is a Wyman Research system that includes an exciter into an SC1043 amplifier brick. The 1280 MHz antenna is a 9 dB gain Diamond vertical.

Activity

If you're in the Bowling Green area, try giving the local ATVers a call on 144.34 MHz. They usually are active every evening after about 8:30 p.m. If you're operating mobile TV, the repeater is located right next to I-65 (near exit 39). Some of the more active ATVers in the region are Hank W4HTB, Dean K4NQV, Fred KA4CFW, Ben WD4MNI, Bob KB4FEN, Randy KD4AMR, and Paul K4VXP (located 60 miles away in Campbellsville).

Night-Vision R/C

During a recent visit to the W4HTB QTH, Hank treated me with a demonstration of his night-vision ATV rover. He mounted an ATV transmitter and an infrared sensitive CCD camera on a USA-1 Monster Truck R/C car. This vehicle is capable of traversing incredibly difficult terrain due to its four monster balloon tires. The camera is offered by Marshall Electronics and has six high-intensity infrared LEDs mounted around the lens, allowing the camera to see about 15 feet in total darkness. Hank has great fun driving the vehicle around under the house as well as venturing out in the woods at night looking for nocturnal creatures. A vehicle like this has a number of interesting applications including potential use as hazardous emergency support.

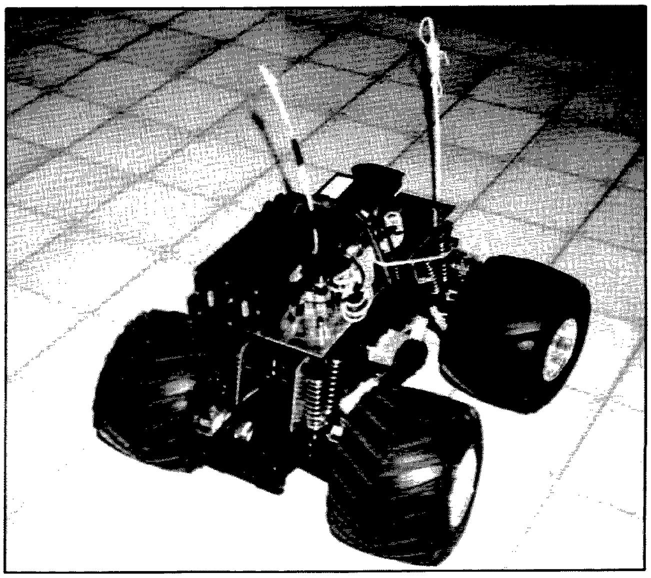

Photo C. The W4HTB night-vision R/C vehicle.

Number 21 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

Frequency

Last month we discussed converting a phase-locked synthesizer/oscillator for 2.xxx GHz. This month I will build on last month's project and describe in detail the multiplier, the filter, and the oscillator drive amplifier. These components serve as an oscillator multiplier, which could be used in conjunction with a 10 GHz converter. The attempt here is to utilize inexpensive surplus components and PC boards to fill a need, and to construct a converter package that is small and functional, and doesn't cost an arm and a leg to duplicate.

Falling back for just a minute, I would like to touch base on the synthesizer, in particular on the power supply you construct to power these PC boards. These devices require a very *clean* DC power supply. By that I mean that the ripple content has to be quite pure or else you will have modulation on your oscillator caused by the AC ripple component riding on the DC in your power supply. It does not take much to cause noise or FM modulation on the synthesizer. To make sure this doesn't happen to you, filter your DC supply well.

Pete Bauer W6DXJ, who has done quite a few of the conversion details on the synthesizer unit, recommends using a good voltage regulator to maintain DC regulation. Additionally, using some ferrite beads on the DC distribution leads at the oscillator to suppress AC and other RF will prove useful. I usually bypass the output of my voltage regulators with not just a suitable electrolytic cap, but with a couple of extra bypass types (0.1 μF and 0.001 μF) as well, to cover all bases on the positive lead. See Figure 1 for the schematic detail of power supply configuration.

The PC boards that I am modifying here were part of a microwave transmitter/receiver used on trucks for communication and data. As such, they were built quite ruggedly and, needless to say, are solid-state, with GaAsFETs in almost all of the circuitry. This month I'll describe the second portion of the oscillator system, namely the oscillator multiplier. Please note that this is but one of many methods used to obtain a 10 GHz injection for 10 GHz operation. The PC boards that are described here are being made available; you can order them for $10 per boaro ppd from the author.

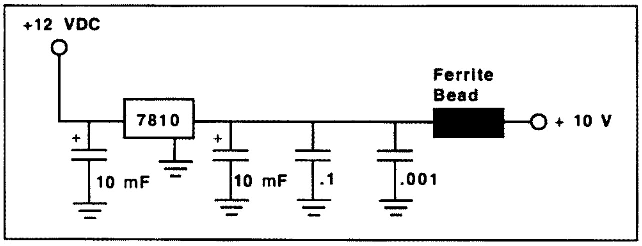

Figure 1. Power supply feed details. Basic voltage regulator power supply; output capacitors vary in value 10-0.1-0.001 μF for wide-range bypass filtering.

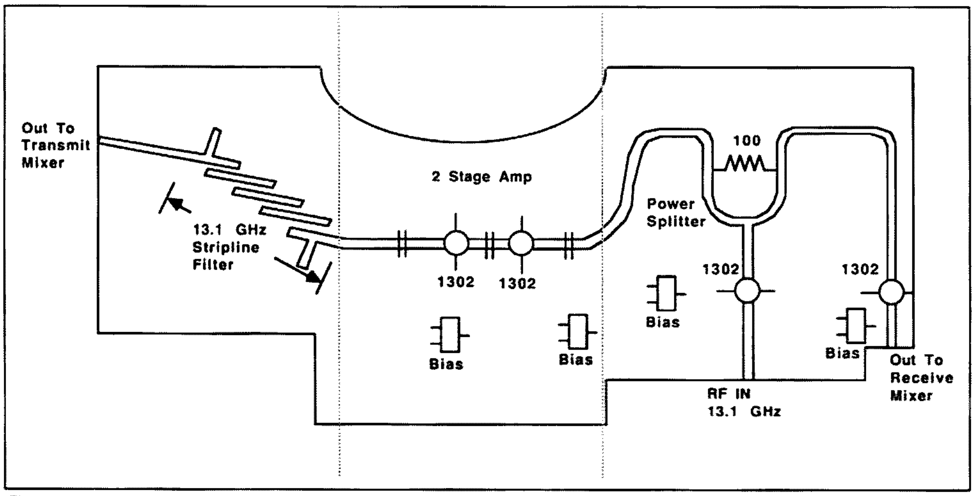

Figure 2. Microwave splitter amplifier PC board diagram. Note the local oscillator mixer drive amplifiers. this PC board uses four MGF-1302 FETs. The dual-stage amp has been cut from the main board and readjusted to 10 GHz.

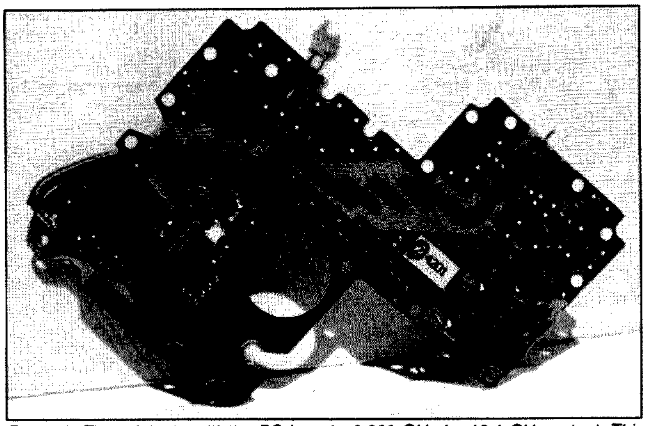

Photo A. The original multiplier PC board—2.620 GHz in, 13.1 GHz output. This uses two Mitsubishi GaAsFETs, MGF-1302.

A brief description of these PC boards: As stock they were made to operate al 2.620 GHz (synthesizer), and the multiplier was a times-five, providing 13.1 GHz output from the set of PC boards. Multiplication was done in the first stage of the second board in an MGF-1302 GaAsFET device. The output of this stage was coupled into a stripline filter resonant at 13.1 GHz to allow bandpass operation of the desired 5th harmonic and reduce all other frequencies. The filter output is coupled with a small-value capacitor to an output amplifier tuned to 13.1 GHz, another MGF-1302 GaAsFET device.

In the original system, the amplifier of the multiplier assembly was fed to a distribution amplifier system on a third PC board. This board contained an input amplifier and power splitter. A power splitter is a stripline device that looks like a tuning fork with the top terminated in a resistance load. Its purpose is to split the signal (one source) into two equal sources: one source for receive and the other for transmit. Two additional amplifiers are located in the transmit path, and there is one in the receiver path. These amplifiers have been removed from this PC board by cutting the board and making two 10 GHz amplifiers, a two-stage and a single-stage unit. This board is not required in the multiplier modification, but can be used by removing the single- and dual-stage amplifiers and converting into individual amplifiers. These amps can be used at 10 GHz as gain blocks with stripline snowflake retuning from 13.1 GHz. See Figure 2, the splitter board block diagram.

The multiplier PC board is of prime concern now, along with our attempt to modify it to a frequency multiplication of four. In this regard we need to modify the output circuit of the first stage from 13.1 GHz to 10.2 GHz. The stripline filter was too difficult to attempt retuning to 10 GHz. A better method is to ellminate the stripline filter by removing the copper foil with an X-Acto knife. Our plan here is to replace the filter with another type of filter that can be easily constructed and assembled—something easier than the original stripline filter. The answer to this problem is an adjustable cavity resonator tuned to our 4th harmonic.

Where do you find such a filter? In the plumbing section of your hardware store. What we used is a 1/2" copper pipe cap plug. Sounds crazy, yes, but it works perfectly and is easy to adjust. Credit for this filter construction goes to the North Texas Microwave Society for passing on the information on the filter construction.

The copper pipe cap works quite well, being simple to construct and adjust. A finished filter will have about 1 to 1.5 dB loss and a bandwidth of about 50 to 100 MHz. I haven't measured the "Q" of the filter but believe it to be about 100. Essentially, the pipe cap filter is a resonant cavity with two probes, input and output.

These probes are copper or brass pins about 0.030" in diameter and 3/16th" long. The pins are inserted from the trace side of the PC board through to the foil side and are about 3/16" high on the foil side. They are

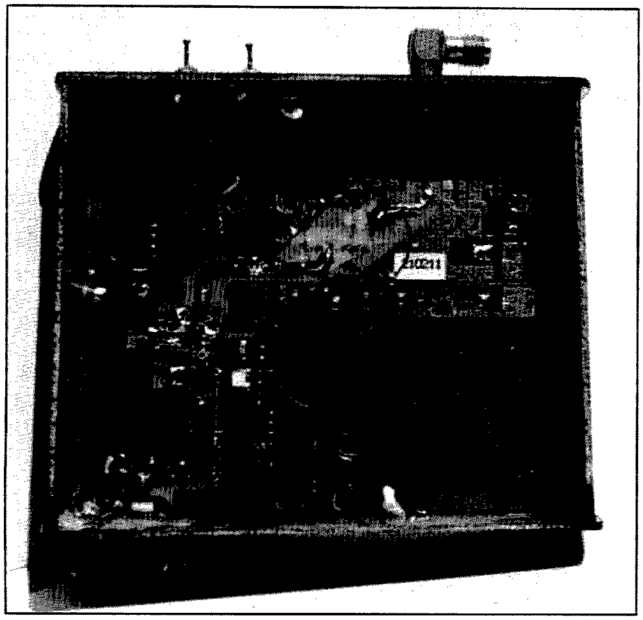

Photo B. The modified PC board, converting the multiplier to a times 4. Note the ink circle mark and the PC strips removed from the filter area, located just above the circle cut-out.

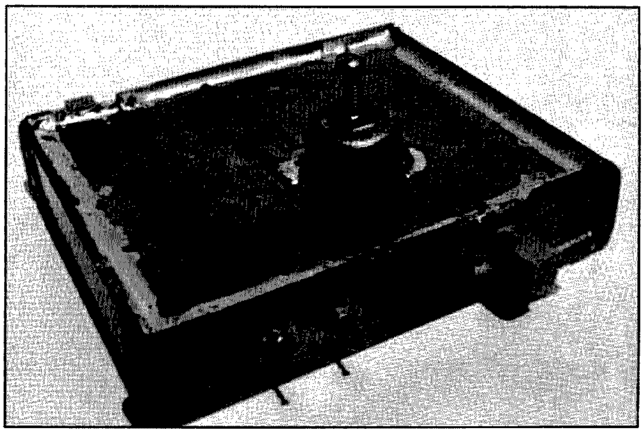

Photo C. The top of the PC board enclosure for the multiplier, showing the pipe cap filter and adjusting screw poking through the lid of the PC board case. Coax connectors for input output and DC feed-through capacitors have been added.

soldered to the remaining ends of the old filter stripline positioned about 1/16" from the inside wall for the pipe cap when it is soldered to the foil side. Note the circle drawn for the pipe cap positioning on the foil side. The stripline that remains from the original stripline filter is now nothing more than 50 ohm stripline which feeds the two probes of the pipe cap filter. You will have to patch the PC board with a few small scraps of copper foil or solder bridge the traces to extend the new 50 ohm stripline to filter probes. See Figure 3 for filter construction details. Exact compliance is not necessary.

I started the modification on the multiplier board by removing the filter traces on the PC board with an X-Acto knife. See Photo A, the original unmodified PC board, and Photo B, the modified PC board. As you can see in Photo B, I drew a circle representing where the pipe cap will be soldered on the opposite side of the PC board, and left copper traces on the stripline side to solder to the probes.

The bottom of the PC board (ground side), where the filter probes are to be, is reamed away to give clearance for the brass pins. This prevents possible grounding of the pins. To ensure this and to give them a rigid structure, I used a portion of Teflon from a scrap SMA microwave connector to slip over the pins for positioning and insulation. If you don't have a connector to scrap, use the pin from a DB-9 or DB-25 connector, as the diameter is just right, and insulate. If you have a Teflon insulator or tubing, slide it over the pin to make the pin rigid and hold the pin vertical and not grounded.

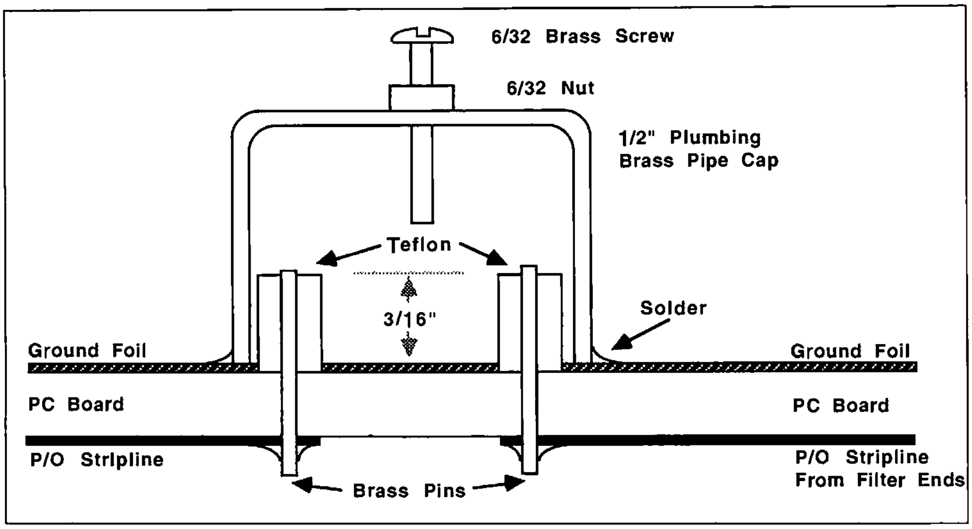

Figure 3. Pipe cap filter construction for 10 GHz operation. The brass pins are 3/16" long inside cavity. Round Teflon insulator is slipped over the pins to hold them vertical and to insulate from the cavity and the 6-32 screw.

Prepare the top of the pipe cap by drilling a hole in the top center of the cap. Tap for 6/32 threads and solder a brass nut over the hole. I used a steel screw to facilitate this operation, as the steel screw will not take solder well. The steel screw is to be used as a centering tool. The idea here is that the steel will resist the soldering operation and only allow the nut to be soldered to the top of the pipe cap assembly (centered on the hole drilled for the 6/32 screw). After the solder cools, the steel screw can be removed from the cavity. A brass 6/32 screw with a nut run up on the screw is placed into the cavity top. If you are not sure what kind of screw you have, test it with a magnet. I am sure you will identify many different screws that you thought were steel or plated steel, and you'll find that they are nonmagnetic and are most likely plated brass. Any of these are OK to use for cavity retuning. See Figure 3 and Photo C for pipe cap cavity details. The design is rather forgiving in the positioning and length of the probes and frequency resonance. The loss of the filter and coupling will be affected by probe length. I find about 3/16" to be a good choice for probe length.

When soldering the cavity (about and insulated from the coupling pins) to the PC board position, (use some form of sleeving on the pins to ensure they stand straight up and are insulated from the cavity side wall. Be ginger with solder in this application and try not to get solder inside the filter—it's very lossy at microwave levels. Don't overheat the pipe cap as components on the other side of the PC board might unsolder with too much heat. Tack-solder the cavity to the ground foil over the probes, near your planned ink line drawn on the opposite side of the board. An exact fit is not necessary; just center the 6/32 screw about the center of the probes and keep the cavity side wall off of the probes. If the cavity wall touches the Teflon, that's OK.

As you can see from Photo B, the finished multiplier assembly I made used scrap copper PC board material to fashion a case for the multiplier. It also made it quite easy to attach coax connectors to the very soft Teflon PC board. This gave the board a rigid feel that made modifications and operations easier on the workbench. During the re-adjustment step of modification I found that most of the gain improvements to the circuit were made on the

multiplier stage. Initially, I connected about +5 dB @ 2.555 GHz to the multiplier input and tried to observe output at 10.5 GHz, the 4th multiple. I cheated and used a bench oscillator for this retuning test and not the modified synthesizer (versatility and test control).

I connected a power meter to the output and found almost nothing for power out (less than -20 dBm). I started to tune the pipe cap filter (inserting the screw into cavity), and as I did the power increased. I tuned the filter for the best power output I could obtain and it was about a -6 dBm. I took a look on the spectrum analyzer and found out that the frequency was what I wanted, and further identified that the filter would only tune to the fourth harmonic, making the conversion of the filter quite easy. In other words, I was quite lucky. With this in mind, I am quite confident that you will not need a spectrum analyzer to make modifications as only a microwave power meter is needed.

To bring the power up I applied the standard "snowflake" copper tuning tools to the PC board to find hot spots. For those not familiar with tuning microwave circuitry and "snowflaking," I am referring to using bits of copper material to be moved about the RF portions of circuit board to retune the circuitry. Instead of moving bits of copper about the board much like a shuffleboard, construct some tools to do the job for you. The tuning tools are made by super-gluing small bits of copper foil to toothpicks. I used round toothpicks and cut off one end to make a slight flat spot to adhere the copper bit to. Make several of various-sized copper bits. I started off by getting some copper foil (from hobby or model railroad shops) and cutting it into miniature pieces about 0.050 to 0.100 square—the exact size is not important. I usually close my eyes and chop up a small piece of copper foil and then select what I want from the cutoffs. Some of these bits will be attached to toothpicks, and the others will be soldered on the PC board traces, duplicating the size and position that the toothpick "snowflake" test produced.

When moving the tools about the PC board, keep the DC power on and be careful not to short anything out—go slow. Remember to turn off DC power when you solder copper bits to the trace, with a duplicate bit of copper as indicated by the tuning tool, on a hot spot. These hot spots found in the "snowflake test" are places where you either add or remove copper from the existing trace. If by coming near a trace the power reduces, this might indicate that you need to remove copper foil or modify the trace at this point. It's like the drop in power is saying, "I don't want any more copper circuitry (in the form of traces), but I want less, so remove some (copper foil)." In some cases the width of a PC board trace need be reduced.

When making any changes, do it in a slow methodical manner and do not make large changes; go slow—a few thousandths at a time—and check for change. The rule is: wide traces, very low impedance; narrow traces, very high impedance. A 50 ohm trace on this type of PC board is about 0.035" wide or so. My hedge on this is that I don't know the exact dielectric constant for the material to calculate it exactly, so this is an estimate. As an example, 100 ohms = 0.015", and 20 ohms = 0.100" wide.

If, on the other hand, power increases when the area is approached by moving the toothpick with a copper bit attached, add copper to this area. Be careful to not short out traces with the copper bits as DC power is on when you are testing with the toothpick tools. When you add or remove traces to the board, turn off the power and use a static-free work station and grounded soldering iron. A temperature-controlled iron is the best iron to use. They operate from low voltage DC and are usually grounded. Static and high voltage soldering irons can produce enough voltage to zap a sensitive GaAsFET device. To minimize static at my work station, I connect a ground wire from my iron's ground to the work piece, a copper circuit board that serves as a common grounded work station. Don't forget the wrist strap with a built-in high resistance discharge path. The high resistance is there for your protection, as well as for static elimination. Ground the PC board with a clip lead to the common workpiece. Everything at common ground should eliminate any static problems.

In hindsight, I found that most of the gain improvements were made in the multiplier stage of the PC board. I obtained a +7 dBm output at 10.220 GHz by using a drive source at 2.555 GHz. No retuning was necessary in the 13.1 GHz stage to obtain this result. More power or better efficiency could be obtained by retuning the 13.1 GHz stage. I just stopped the modification without retuning this stage as +7 dBm power was all that was needed for a good mixer injection level. If you want to re-tune the multiplier's amplifier go about it in the same manner as the multiplier stage.

Well that's it for this month. As always, I will be glad to answer questions about this topic and related material. Please Send an SASE for a prompt reply. Next month I will cover a surplus Loran receiver that can be computer-operated to give you Lat-Long positions and convert them to six-figure grid squares for grid-square hopping. 73 Chuck WB6IGP

Number 22 on your Feedback card

DEALER DIRECTORY

Number 23 on your Feedback card

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Peterborough NH 03458

Getting Clipped

Radio as we know it today is an analog medium. Oh, sure, there's lots of digital control, and some digital signal processors have begun to appear. Still, in the end we modulate a carrier of some sort with some kind of analog information, even when we actually want to send digital data. The possible exception is CW, although that's debatable. But what exactly separates the digital and analog universes, and what happens when you push them beyond their limits? Let's take a look at some of the ways, both analog and digital, to represent information, and then examine the consequences of overdriving, or "clipping," them.

Squash

Just what is clipping? Well, imagine you're a circuit of some kind. You have limits, beyond which you just can't give any more. Along comes this signal which is so strong you can't handle it all. So, you give as much as possible and, when the signal goes out of bounds, you just stay at your output voltage limit until it comes back within your range. If we now graph your output or look at it on an oscilloscope, the highest and lowest points will be squashed flat, or clipped. That's serious distortion, and it has differing consequences, depending on what's being clipped.

In an analog system, information is represented by a changing signal which in some way mimics what you want to send. There are various ways to do that, and each behaves differently under clipping. Let's look at a few.

Baseband

You may have heard this term used to describe many kinds of signals. But, underneath all the definitions, such as video, data or audio, lies a common concept. Baseband refers to the original modulating signal, before it is impressed on something else. So, in a stereo system, baseband audio is just plain audio. In other words, it is not digitized, FMed, or whatever-ed. In video, it refers to the video signal as it comes from the camera, VCR or other video source. Especially in video, where RF modulators are common, the term really helps to keep things straight: is this switch handling baseband or RF? In radio, baseband refers to the signal you wish to send, or the one you've received after demodulation.

Sometimes, though, the definition can get murky. Let's say you receive an SSTV signal on 20 meters. Out of your speaker come the warbling tones which represent a picture. Are they baseband? Well, as far as the radio is concerned, they are, because they are demodulated audio. But, SSTV is sent as FM, meaning that the frequency of the warbling tones is proportional to the instantaneous brightness to be displayed on the TV screen. So, we don't really get to baseband *video* until the SSTV converter's FM circuits demodulate the tones into a varying voltage representing the picture elements. That voltage is truly the "baseband" video signal, albeit slowed down. Even more confusingly, the time-converted video signal actually sent to the TV monitor is also baseband video fast-scan video.

When you clip a baseband signal, its tops and bottoms get flattened. With audio, it sounds like tremendous distortion. With video, it disturbs the sync pulses, which are at the bottom of the signal, and it turns high-brightness points, such as facial highlights, to white. The sync disturbance can result in wiggly pictures which tear and roll as the scene changes. ATVers often have to wrestle with this problem, because it is hard to make RF transmit amplifiers which stay completely linear from edge to edge.

AM

This is one of the earliest modes, yet still one of the most complex. The modulating signal changes the strength of the carrier. Seems simple, right? At first, that appeared all there was to it. After a short time, it became clear that much more was going on. The concept of sidebands, in which the modulation appears in mirror images on either side of the carrier's frequency, was not immediately believed. It took quite a bit of mathematical development, and significant measurement and observation, before the sideband theory was accepted. Even now, you can hear debates as to exactly how much power is going into the sidebands and how much into the carrier, which is presumed not to actually change strength, despite how it looks on a scope!

Clipping an AM signal has drastic consequences. The amount the sidebands spread from the carrier depends on the modulating frequencies. When we clip, though, the rate of change of the carrier at the moment of clipping becomes very high, implying a

much higher modulation frequency than is actually present. That results in all kinds of sidebands very far from the carrier, which we call "splatter." It's a mess, both spectrally and legally.

SSB

Sideband, which is a special form of AM, suffers from the same problems when overdriven. But how can we clip a carrier when there isn't one? Well, remember that we are generating an RF signal and then making it cancel itself out in the modulator. The object is to create sidebands, one of which we then throw away and the other of which we send on to the antenna. If we clip the modulator, it generates the same kinds of false sidebands we'd get with AM, and we wind up sending those on one side. Of course, the sideband filter will keep the extra-wide ones in check. But, if the clipping occurs in the final amplifiers, the mess makes it to the antenna because it happens after the sideband filter.

FM

Is it possible to clip an FM transmitter? In theory, no. After all, we're just wiggling a carrier's frequency back and forth, so there should be no limit as to how wide we make it. In practice, though, the circuit stages have bandwidth limits. When we deviate the signal far enough to run into those, they will begin to cut the signal off as it approaches the outside points. The result is an "AM-ing" of the signal as its strength goes up and down, along with AM-like splatter and distortion.

The FM receiver is a special case. Its clipping points are set by the IF bandwidth and, especially, the detector bandwidth. If the transmitted signal exceeds the IF bandwidth, it'll get AM-ed just like it would in the transmitter example. If the signal exceeds the linear bandwidth of the detector, it'll clip the audio just as if it were an overdriven baseband amplifier.

> ***"Baseband refers to the original modulating signal, before it is impressed on something else."***

There's one place, though, where clipping is deliberately employed in an FM receiver in order to reduce susceptibility to impulse noise and other amplitude phenomena. In fact, this kind of clipping is what is responsible for FM's inherent superiority to AM in that respect.

The basic technique is to push the IF amplifiers beyond their linear limits, forcing them to clip. That flattens any noise spikes or other changes in amplitude riding on the received carrier. What's left is just the carrier signal, with nice, flat ends. Of course, it's a kind of serious distortion, but does it matter?

Not in this case. Remember, with FM the information is in the wiggling of the carrier's frequency, not in any amplitude changes. That frequency will survive the clipping process just fine. In fact, it'll be the only thing left, which is just what we want.

By the way, that rushing noise you hear when there's no signal on an FM receiver is caused by the same process; the small amount of internally generated noise in all circuits is amplified by the clipper (also called the "limiter") to the point where it wings from rail to rail (the upper and lower limits) and is detected as random noise.

Intermod

Intermod is caused by clipping, usually in the front end of a receiver. The overloading signals cause the front-end amplifier to distort, creating all kinds of sidebands of its own. Those then look like phantom signals. Also, clipping causes mixing of otherwise-unrelated signals, causing odd blends of them all over the dial. And, when a very strong foreign signal is present at a transmit antenna, intermod can occur in the final amplifier of the transmitter, making it broadcast the mess all over town, or even all over the world. If you don't believe me, ask any urban repeater owner.

Well, I hope you've enjoyed getting clipped in the analog domain. Next time, we'll take a look at what happens when signals clip in digital circuits. Now, let's look at a letter:

Dear Kaboom,

I have two mobile 2 meter rigs. With a strong signal, they're both fine. But, when I listen to a weak signal, the older one always seems to pick up lots of ignition noise, while the newer one doesn't hear it, even when I use the same antenna. Is the staticky one broken, or can I adjust it somehow?

Signed,
Headache #12

Dear Headache,

What a relevant letter for this month's discussion! No, neither of your rigs is broken, and there's nothing you can adjust. The quieter receiver has better-designed IF clipping stages, so it rejects more AM, which is what ignition noise spikes appear to the rig to be. I'm afraid you're stuck with it.

Until next time, 73 de KB1UM.

Number 24 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
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Notes from FN42

Before I started the column this month, I just had to reread the report from the Peter I DXpedition written by Peter ON6TT. He has such a great sense of humor spread throughout the report. I just wish that we had the space to print it all.

Another Mother's Day approaches as I am working on this column, which means that Hosstraders is just a few days away (the Friday/Saturday of Mother's Day weekend). It is another "great happening" similar to Dayton and others, but mostly tailgaling out-of-doors.

There is much for all—one person's junk is another's treasure. It is really something to just sit back and watch the smiling faces go by lugging a "boat anchor" from days past. You've probably seen that same boat anchor go by during past Hosstrader's, too, if you really kept track.

I've already been given my "marching orders" from headquarters (my XYL): "No new stuff unless you get rid of some of the old stuff." She's said it in the past, and this time she really means it! It you saw some guy crying as he unloaded some of his "treasures" at bargain prices, it was probably me!. I hope that you were one of the lucky ones to get one of my "treasures." 73 'til next month.—Arnie N1BAC

Roundup

Brazil *From the WWSA News—Jan/Feb 1994:* The Brazilian magazine *Antenna-Electronica Popular* invites all amateurs worldwide to participate in the 13th edition of the well-known WWSA CW Contest.

The contest is held on the second full weekend in June (June 11-12, 1994) starting on Saturday at 1500 UTC and lasting until Sunday at 1500 UTC. A separate log lor each worked band must be sent no later than July 31 to: WWSA Contest Committee, PO Box 282, ZIP 20001-970, Rio de Janeiro, RJ-Brazil.

Germany *From the Deutscher Amateur Radio Club (DARC):* How to Apply For a German Short-Term Amateur Radio Licence: Licenced foreign amateurs staying temporarily in Germany (on visit or in transit) may obtain a short-term amateur radio licence from the Deutsche Bundespost, valid for a period of three months, by directing their application, at least six weeks in advance, via Deutscher Amateur Radio Club, International Affairs, Postfach 11 55, W - 3507 Baunatal 1, Germany to Oberpostdirektion Dusseldorf. Licence fee and handling costs for a three-months' licence amount to DM15 (deutsche marks). This sum should be transferred, at the same time as the application is sent, in German currency (no IRCs, no stamps please) by postal money order to: Postscheckkonto (postal cheque account), no. 56 13-430 at Postscheckamt Essen, BLZ 360 100 43, for DARC—International Affairs—w—3507 Baunatal 1.

A German licence will only be granted il the applicant possesses a valid amateur radio licence of his national administration which is at least equivalent to the German licence class requested.

In the application, the following should be given: 1) Nationality of applicant; 2) First name and surname; 3) Date and place of birth; 4) Home address; 5) Home callsign, class of licence; 6) The three months' period requested; 7) Address of location of operation; 8) Address to which the licence document is to be sent; 9) Confirmation that the licence fee has been forwarded to the Postscheckamt Essen (photostat of payment slip); 10) Photostat of your home amateur radio licence, together with an indication of the date of issue and duration of validity, class and comparable German class of licence (Class C—144 & 430 MHz only; Class B—All HF band frequencies and 144 & 430 MHz; Class A—3520-3700, 21090-21150, 28000-29700 kHz, 144 & 430 MHz.); 11) Membership in a national amateur radio society (yes/no), and the name of the society. German short-term amateur radio licences are issued to foreign amateurs for periods of three months only, beginning on the first day of the month, as requested by the applicant. The short-term licence will entitle the foreign amateur to operate a fixed, mobile, or portable amateur station.

Peter I *Info from Peter ON6TT, European Coordinator 3YØPI:* There was excellent propagation during the first days of the operation. Europe was coming in fairly weak during the first week, which was of major concern to us. Propagation was very unpredictable. Sometimes we could work EU on 20m, from 0400 on, while the next day we could not hear them at all during the EU-morning. Sometimes 40m to EU opened up at 0000, sometimes as late as 0600. During the second week (excluding the weekend, unfortunately), signals from EU were fairly strong, but it seemed that despite 2 kW and yagis, EU could not receive us very well.

30m was a disaster. The band was almost completely covered with South American SSB pirates. On 40m and 80m we had problems attracting EUs' attention, especially in SSB. We would hear very strong signals, but could not get anyone to answer us. In that case, we answered somebody's "CQ DX" (most of the time he would not believe it was us answering his call) and asked him to look for a frequency clear for us to transmit on. Normally, this worked. Reception on the low bands was very good, though (no man-made noises). We had only one good opening to EU on 160m.

After one day of operation, we found that stateside would cover up all EU signals, so we favoured EU from the moment we could hear them. Sometimes, we tried to work very weak EU-signals, leaving 9+30 USA people waiting for a while. Nevertheless, we could not leave any continent waiting for too long a time, so sometimes it could happen that you would hear us with weaker signals working the USA, and not working Europe. And believe me, this was not easy. We held statistics on what continents were worked on what bands and modes, so we would give everybody an equal chance for as many band modes as possible.

Living conditions: We had two operating shelters of 8 x 8 ft. (one CW and one SSB), a kitchen shelter of 8 x 12 ft. (used to sleep, awaiting evacuation of the island), and a sleeping shelter of 12 x 24 ft. Shelters were warmed with propane heaters (six bottles of 100 kg propane each). Our separate top-open toilet shelter with a homemade toilet seat proved to be very useful (but we had to count on digging out five feel of snow before "taking a sit").

Power: Two 4 kW Onans and two 5 kW Hondas, with 14 barrels of gasoline (200 liters each). Don't worry if the

Onans lose parts like bolts, nuts, mufflers and pilots. As long as they keep on vibrating on their wooden crate-cover bases, while trying to mate with the Honda next to them, they tend to keep on working.

Antennas: 15, 20, and 40m monoyagis; 10-15-20 tribanders, 12-17-30 tribander, HF verticals, wire antennas, and 70cm/2m yagis for satellite.

Radios: Nine Kenwood rigs of various kinds (four died during the operation); four Alpha amps, which ran beautifully without a hiccup. Various satellite and RTTY gear was QRT upon arrival (rough handling) or went QRT shortly thereafter.

Computers: For various reasons, computers were only used for RTTY, and by one op for logging. After five days we were left with only one working computer power supply. Most of the logging was done on paper. Yes, you can run RTTY pileups, even if the only way to switch between transmit and receive is by resetting the modem.

Luckily, all people involved (hams from the London area, Falklands, Punta Arena, locals from Falklands, the Antarctic bases and South America) were *very* helpful; we were well prepared (shelters, clothing, transportation) and had extensive spare equipment; we had the pilot stations (thank you John ON4UN and Mark ON4WW for the super job as the European pilots!) to keep us linked to the DX community, to our homes, and to all kinds of people involved in this operation (transportation, manufacturers, etc.). Both of you put in so much time, effort, and quality in your tasks that it is difficult to thank you enough; as operators, we were very motivated to bring this challenge to a good end. I think it was this motivation that got us through.

It is really difficult to describe all of the non-radio stuff involved in such an operation. Come to one of the upcoming presentations and you will understand. One thing: We were not complaining about the hardship we went through. On the contrary, all of us are proud, very proud of what we did.

[I wish that I could have printed the complete report from Peter ON6TT. It has a genuine humor that makes easy reading and makes certain humorous points about the living conditions endured to bring the rest of us contacts from one of the "rare ones." Thank you all for a job well done!—Amie]

MONACO

Daniel Plett 3A2LZ
B.P. 349
MC 98007

Greetings to all from Monaco. This has been a rather quiet spring here in the Principality—not too much unusual going on. The Association des Radio-Amateurs de Monaco had its annual meeting. The first order of business was the election of the council for this year. Most of the council members remained the same. The only change was at the position of General Secretary. Claude Passet 3A2LF, who has worked hard at that position for a number of years, is taking a year off. Serge Salganik 3A2HN is filling the position for this year.

A number of projects are in the works. Last year, some of the local hams were asked at the last minute to help the Monaco Red Cross during the Monaco Grand Prix. They apparently liked the help and have asked us to help again this year.

A foxhunt/direction-finding competition is planned for June 19.

The Monaco repeater is about the only repeater between the Italian border and Nice, France. The mountains further complicate VHF communications in the area. The Monaco repeater has an unusual split though which cannot be accommodated with many 2 meter rigs. One of our projects is to modify it to work on a normal split.

There is no further news on the 6 meter situation. 6 meter activity in Monaco and the nearby part of France is still prohibited.

Finally, I1YRL was legally active from Monaco the beginning of April, especially on 30 meters. Congratulations if you worked him.

Let me remind you again that the Monaco QSL bureau can only be used for members of the A.R.M. We receive a number of QSLs for nonmembers, and this causes problems. And, the only correct address for the A.R.M. is Box 2, Monaco. A number of other addresses appear in various DX publications but are incorrect.

Best 73 from Monaco. Daniel 3A2LZ.

PHILIPPINES

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First, thanks for the many letters from the readers of this column. I enjoy answering my mail but can't afford to answer letters without an S.A.S.E. I already have a lot of BURO QSLs to answer for IOTA OC-129, and also many direct cards without S.A.S.E.s, which I have no choice but to return via BURO.

This month I decided to bring our readers up to date with the additional guidelines for the renewal of an amateur radio license and application for amateur radio examination.

I. Renewal of Licenses: 1) Before an Amateur Radio License or Operator's Permit is renewed, the applicant must show proof of his/her involvement in amateur radio activities. An Amateur Radio License holder may be involved in any of the following: a) DX—He/she must be able to present Log Extracts and/or QSL cards, DX Awards earned as a result of his/her DX activities; b) Technical Experimentation—He/she must show proof of being involved in the technical aspects of the hobby, which may include propagation tests and exploration, electronic innovations (such as the improvement of present equipment and accessories), home-brewing of equipment and accessories. These must be properly documented with the submission of test results, drawings and circuit diagrams where necessary; c) Emergency Communications—He/she must show proof of having been involved in purely Amateur Emergency Communications and, in the case of an emergency or disaster situation, participation and active membership in the Amateur Radio Emergency Service (ARES) will suffice; d) Active membership in an Amateur Radio Club—An amateur radio enthusiast can only grow and progress in his/her hobby through an exchange of ideas and the support of his/her fellow amateurs. Membership in an NTC recognized Amateur Radio Club therefore is vital and important. This is optional but highly encouraged; e) Field Expedition—This amateur activity is highly encouraged for radio amateurs. A group can conduct a field expedition by securing for a permit from the Commission (NTC) and a corresponding special DX callsign will be assigned for the purpose.

2) The proof of Amateur activity will come in a form to be submitted by the applicant with his/her application for renewal (Form ARSCP-001). This form must be endorsed by a local club, duly recognized by the NTC as an Amateur Radio Club or a Class "A" Amateur Radio license holder. The applicant need not be a member of the club where the endorsement was obtained from, but the club or Class "A" endorser shall be held responsible for such endorsement of the applicant.

II. Applicant for Amateur Radio Examination: 1) An applicant for the Class "C" or "D" amateur radio examination is required to attend an orientation seminar conducted by an authorized radio club or a Class "A" amateur license holder with corresponding endorsement before he/she is allowed to take the corresponding examination; 2) The authority of an amateur club or Class "A" amateur license holder to hold seminars and endorse examinees can only be issued by the Amateur Radio Consultative Panel. The authority given to an amateur club or a Class "A" Amateur license holder shall be for a period of one year only (renewable) unless sooner suspended, canceled, or revoked for failure to comply with the standards and agreement set-forth by the Amateur Radio Consultative Panel.

Never Say Die

Continued from page 4

gram like this and I've missed It, please let me know.

It allowed me to enter the monthly sales figures for up to 10 years of sales and would display them. Then I could ask it to do a graph of the figures and it would give me max and min numbers and ask what max and min I preferred for the graph. Once I typed those in It would present the graph, showing the sales for the 10-year period. Okay, we probably have programs today that'll do that much. The next step was to ask it to do a moving average of sales. It would ask over what period. I'd tell it 12 months. It would consider that for a minute and give me a chart of the numbers. Then I'd graph the moving average. These graphs and charts could be easily printed, just by hitting a key combination.

Now we come to the more valuable part. It could calculate the second derivative of the sales figures, showing the acceleration or deceleration of sales. I found that the number of pages of ads in *73* and in *QST* both had a curious 18-month sine curve that continued for years. Even more valuable was the ability of the program to project sales into the future, based on trends and taking into consideration periodic changes, such as seasonal sales changes. Is there anything out there that can do this? I'll buy it!

We're not talking Einstein here. The math required for all this is relatively simple, it's just that no one has bothered to build this Into a program for the last 15 years. Phooey. Instead they've been busy providing us with three-dimensional graphs and junk like that. Hey, guys, keep it simple!

So what happened to Instant Software? It was a good idea and it did fairly well, but when I sold my computer magazines to IDG, they didn't want to be bothered with mass-produced software. And without the infrastructure provided by the magazines, It couldn't continue. But we learned a lot and had tons of fun doing it.

For instance, we learned not to try to sell educational software to schools. We wondered why some of our prize-winning stuff was selling so poorly. When we studied our sales we found that we were selling one copy to each school and they were making all further needed copies. A couple years later we did another study and found that by then we were selling one copy to each school district. I talked with several other software companies and found they had the same experience. That's when educational software stopped being produced. And that's one reason we still don't have much of it that's any good.

At our peak in 1983 we had around a hundred people employed, were supporting over 250 good programs, were expanding rapidly into Europe and considering opening an Irish plant. Then IDG pulled the plug.

Let me know if you ever see a good business analysis program for the Mac.

Ahh, the Mac. I went out to Cupertino for the unveiling of the original Mac. There was tremendous hoopla, but I wasn't impressed. The IBM PC had come on the market the year before and it almost instantly wiped out the TRS-80. Up until then the microcomputer market was split with Radio Shack having 40% of sales, Apple another 40% (Apple II), and about 200 smaller companies sharing the other 20%. Old-timers will remember CompuPro, Morrow, Ohio Scientific, Midwest Scientific, and a bunch more.

Apple was semi-friendly to third-party supporting businesses, but Radio Shack was hostile. Really hostile. So when IBM came along, they had no problem in capturing most of the third-party support from Radio Shack, and that quickly collapsed Radio Shack sales. They went, in about one year, from 40% of the market to about 4%, and have never really recovered. The chairman, John Roach, never forgave me for predicting that this would happen unless they changed their policy of fighting third-party support. But did he learn from this? Har-de-har. So Radio Shack has been a very minor player ever since and Radio Shack lost billions in potential sales. Tens of billions. My view is that they could have prevented the IBM putsch, if they hadn't been so blinded by their own greed.

The Mac? It didn't really get anywhere until desktop publishing came along. The Mac has stayed a year or two ahead of the PC in that field, and that's been Its main strength. The Mac PowerBook was a major step ahead for writers like me. I'd tried several PC-type laptop computers, but none of them were as easy to use as my old Radio Shack TRS-80 Model 100, which I bought the day it came out in 1983. That went everywhere in the world with me.

Last year I was about to start a PowerBook magazine when I saw the trouble coming for Apple as a result of Scully's ego-lascination with the Newton. That got him fired, which was well-deserved, I thought. But his replacement seemed weak, so I was afraid that Apple would be rudderless. And that's about the way things have turned out. My decision to not start the PowerBook magazine last year has proven to be prescient.

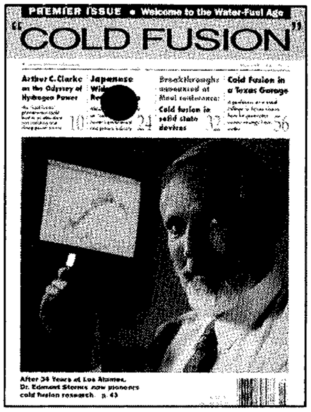
Scully, swept up in his visions of the information superhighway, jumped without looking very carefully to another firm, which turned out to be built mostly on vapor, which Is a common enough foundation in the computer field. So Scully is joining the parade of has-beens in the field . . . like Jobs, Tramiel, Busey (TI), DeCastro (Data General), Olson (DEC), and An Wang.

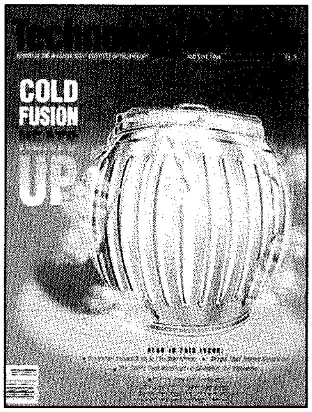
Oh, you probably don't care about all that old stuff anyway. I just can't help remembering how interesting it was in the early microcomputer days. I really should write about them some time.

Cold Fusion Validation!

The *Popular Science* article last August saying that cold fusion had been given a premature burial by some powerful vested interests almost got me to thinking. Like many others, I'd been excited over the prospects cold fusion offered when Pons and Fleischmann announced the break-through in 1989. Then the whole idea was trashed by some vocal scientists, who were given the usual extensive media coverage providing bad news.

Then I read in the Rensselaer *Review* that students had confirmed the generation of excess heat as reported by Pons and Fleischmann. This was followed by two books blasting cold fusion as a hoax. What in heck is going on here?





Next I heard from a *73* reader who was deeply involved in the cold fusion field. He assured me that the effect was quite real, despite the naysayers. He started sending me information confirming that researchers worldwide had successfully duplicated the early experiments and were busy developing the technology. He convinced me that there was a need for a magazine to help this new technology grow into an industry. It didn't take a lot of convincing.

I'd seen the power of a magazine when I decided to try and pull amateur radio out of its deep decline following the catastrophic ARRL relicensing effort in 1964, when our growth went from 11% per year to around a 3% negative growth. We needed something new to get the hobby going again and 2 meter FM and repeaters seemed like the ticket.

So I began publishing hundreds of articles on the subject in *73*. Then I started the *Repeater Bulletin*, to further push the technology. That was followed by a series of books and repeater atlases. It was the Chicago hams who developed the cellular approach for their repeater system. Once I saw that I knew that it wouldn't be long before this service would be made available to the general public.

Within a couple of years we went from having isolated repeaters put up by pioneers to a nationwide network. I found myself able to make repeater-assisted phone calls while I was on skis in Vermont, almost anywhere in New Hampshire, and even from the ski slopes in Aspen! Sure enough, GE and Motorola grasped the significance of what we'd developed and cellular telephones were born.

Personal Computers

It was my success with repeaters that got me to thinking about the critical importance of a publication to help new technologies develop into industries. The articles I published in *73* and the *Repeater Bulletin* had helped the pioneers speed up their research by providing the needed communications. Further, my publications attracted the interest of more pioneers and helped bring them up to speed. And lastly, they made it possible for entrepreneurs to go into business supplying the pioneers, building an industry.

Within three years repeaters had become the largest single interest in amateur radio and built a $100-million new ham industry. I particularly enjoyed that because the first reaction of the *73* readers was to complain bitterly about my publishing so many repeater articles. I got hundreds of letters threatening to cancel subscriptions if I didn't cut it out. Then gradually I began to get letters saying, hey, this stuff is fun . . . thanks. At the time I was the only ham publisher covering this new technology, so I felt that *73* deserved most of the credit for what resulted.

When, in January 1975, the first microcomputer was announced, I saw the significance of the technology and decided it was time to see if I could do it again. I started trying to find an editor who understood computers. For months I chased after the editors of computer hobbyist newsletters to see if they might be interested in working with me. Finally, in May, I found a chap in Boston who had been publishing a hobbyist newsletter with about 200 circulation. He was game to give it a try.

I set to work getting articles from ham authors who'd been submitting computer-oriented material to *73*. I got the names and addresses of anyone who'd ever written to the suppliers of parts for computers. Some of them, like Bill Godbout, had been advertising

quite successfully in *73*. I got shoe boxes full of names from these companies and sent out subscription offers. The response was incredible. Most direct mail is considered a success if one percent of the potential customers buy. I was getting 20%!

The first issue of *Byte* came out in August 1975 and looked pretty good as a starter. The *73* editorial and production staff had done most of the work. It was just five weeks from the time we'd decided to start the magazine until the first issue went on the presses! I decided to visit the prospective advertisers personally, so I made a trip to Albuquerque to talk with Ed Roberts, who started it all with his MITS 8800 Altair microcomputer. I also visited Sphere in Salt Lake City, a computer game group in Phoenix, and Southwest Technical Products in San Antonio, bringing copies of the first issue with me. I also stopped by to say hello to my old friend Ed Juge, a *73* advertiser who owned a ham store in Fort Worth. I gave him a copy of *Byte* and warned him that microcomputers would turn into a huge industry. Ed had managed to survive the "Incentive Licensing" holocaust, but by 1975 was ready to give up trying to run his store.

Later I found that he'd gotten so excited over the magazine I'd left that he bought an MITS Altair and had become addicted. When Radio Shack got into the business with their TRS-80 Model 1 in 1977, Ed got one and started programming it. In fact, when I went into the business of selling software in 1978, two of my first program releases had been written by Ed. The next thing I knew Ed was working for Radio Shack. He's still there.

Between *Byte, Kilobaud, Microcomputing, 80 Micro, Desktop Computing, InCider*, and a few of my other publications, plus dozens of books and hundreds of software programs, the personal computer industry grew rapidly. By 1982 *Byte* was the largest consumer magazine in the country and my *80 Micro* was the third largest. *Vogue* beat it out for second place.

Compact Discs

When the compact disc was introduced to America in 1982 I decided there was a need for a magazine to help this new technology grow. I started work on this in 1983 and within a couple years it had become the most influential music magazine in the country. CDs became the fastest growing consumer industry in history.

When Sony came out with 8mm video I tried to interest them in a supporting magazine. I was unable to get any cooperation from them. They didn't see the importance and refused to talk about it. I wonder how big that industry might be today if Sony hadn't been run by marketing people with blinders.

Cold Fusion

Considering the strength of the opponents of cold fusion, mostly made up of scientists getting billions of dollars to try and develop hot fusion, and rightfully afraid that cold fusion might drain some research dollars . . . or even put them out of business . . . getting a supporting magazine started looked like an uphill job. Worse, since everything was still in the research phase, there were few potential advertisers.

As I looked into the situation I found that while labs around the world were reporting success in generating unexplainable heat, no one had a theory that explained what was being reported. Researchers were empirically trying this and that. They needed better communications.

The prestige science magazines refused to publish anything about the field. Since what was being reported was "impossible," therefore every scientist involved had been making stupid mistakes or else lying about their data. This mindset controlled the Department Of Energy (DOE), and even the US Patent Office, where cold fusion was classed as being as impossible as perpetual motion.

Pons and Fleischmann were so upset over all this that they left the country. The Japanese quickly took advantage of the situation. Toyota approached Pons and Fleischmann and offered to set them up with a dream laboratory on the French Riviera . . . where they are making great progress with their research.

I decided to go ahead with a publication. I announced it at the Fourth Cold Fusion Conference on Maui in December. My editor was Dr. Eugene Mailove, the author of *Fire From Ice*, the only even-handed book on cold fusion. At the conference I listened to hundreds of papers reporting the progress in the field and had an opportunity to meet the scientists involved. Yes, including Pons and Fleischmann. It was an exciting conference.

Upon returning to New Hampshire we started working on *"Cold Fusion"* magazine. We put the title in quotation marks because no one yet has a good theory of where the enormous amounts of heat being generated are coming from. The first issue was mailed in April, dated May on the cover. I didn't need any jokes about it being an April Fool magazine.

In late March the BBC and CBC (Canadian) broadcast well-researched documentaries on cold fusion. They gave time to the naysayers, but they left no doubt that the phenomenon was quite real and probably the most important scientific discovery of the century.

This was followed by the May issue of MIT's *Technology Review*, which had a cover feature on cold fusion, complete with an 11-page article by Dr. Ed Storms, who was our cover scientist for the first issue of *"Cold Fusion,"* so things were beginning to break. Just to give you an idea of how positive this article was, let me give some quotes.

"Some cold fusion experiments have reportedly produced power densities higher than those of uranium-fueled fission reactors . . . Experiments that use crack-free palladium and follow the proper procedures now routinely produce heat, nuclear products, or both . . . For cold fusion to occur, the palladium probably must transform into a special condition of matter, akin to superconductivity . . . None of the proposed explanations for cold fusion accounts for the full range of experimental observations."

My predictions of cold-fusion-powered cars with a sealed unit that would provide power for years was being backed up by Nobel-Laureate scientists. Sure, the first products will be big and expensive. You only have to visit any science museum to see what early steam engines and internal combustion engines looked like. But as we find out more about this power source I believe we'll have fuel-less planes and $100 round trips to Africa. We'll probably have micro-sized generators powering wrist communicators. Shades of Dick Tracy! Our homes will be heated and powered by units smaller than a bread box. No more need for oil, gasoline, natural gas, coal, those big wind turbines, or even inefficient solar power.

Free power? Just about. No more gas stations or oil spills. No more coal mining or well drilling. Well, we needed something. With the known reserves of fossil fuels already 50% used up, the era of low-cost oil and coal was coming to an end.

The Opportunity

With the deathblow to the naysayers by the *Technology Review* article, we'll start seeing some money going into R&D here in the US. Japan is way ahead of us in this field, so we've a lot of catch-up to do. Considering the head start Toyota has, I'm predicting that perhaps as soon as the 1999 model year we may see a free-energy Toyota announced.

We're going to see many more millionaires and billionaires as a result of this new industry. And we're going to see a mighty scramble by the power and oil companies to cope with the changes. The power companies haven't been as impressed by the naysayers as the government, so they've been helping to fund some research. I suspect they've a game plan of reducing the cost of electricity with this new technology, and thus hoping to stave off a massive move toward home power units.

One outfit, ENECO, has been working quietly to get as much control of the patent applications in the field as possible. This could pay off big for them. The scientists involved need a business organization to represent their interests, and to help fund their continuing research, so it's a good marriage.

With the publication of *"Cold Fusion,"* the TV documentaries, and the MIT article, I think we'll even see the media beginning to take a positive look at what's been going on.

Yes, the chemistry and physics involved with cold fusion seem formidable. But when you remember that even the experts are unable to explain what's happening, maybe coming up to speed in this new technology isn't as impossible as self-defeated people alibi. When solid-state electronics came along in the 1950s many of the old tube people gave up and didn't even try to keep up. Transistors turned into ICs, which got ever more complex. In an effort to build a universal controller chip, Intel came out with the 4004. This was upgraded to the 8008, the first 8-bit chip. Hobbyists took one look and decided they could turn this controller chip into the heart of a microcomputer by adding appropriate software. That was the beginnings of the microcomputer revolution. Intel upgraded to the 8080 chip, which Ed Roberts, a computer hobbyist, used as the heart of his Altair 8800. This product came just in time to save MITS. They had bet the farm on solid-state calculators, which they were selling for $130. Just as calculator prices dropped by about 90% Ed announced the Altair and got over $5 million in orders in 1975.

So I had to start over and learn how computers worked. It wasn't easy at that time because there weren't any textbooks worth a damn.

Now I'm learning about palladium loaded with hydrogen. Again there are no textbooks to help. I'm learning about nickel and hydrogen, and so on. And I'm not doing one single thing that you couldn't do, if you had the interest. I'm learning about deuterium, tritium, neutrons, gamma rays, and so on. It's exciting. I'm almost beginning to understand the arcane language of the scientists working with this stuff.

And like almost everything else I've tackled, I've found that it isn't a question of brains, it's just one of perseverance. Edison pointed out that genius is 99% perspiration and I have no reason to question him on it.

Oh, it does help to keep an open mind and absolutely refuse to ignore anomalies. Pretty soon you find that things start fitting together and making sense.

No, no one yet has a good theory for how the cold fusion effect works. But then we don't have a theory we agree on yet for electricity, gravity, and even inertia. Many scientists are going back to the concept of "ether" as a medium in which radio and light "waves" travel. If you read much, you'll be reading about all that.

As you get into all this you'll find there are a mass of newsletters and departments on CompuServe and the Internet dedicated to discussing these ideas. What there isn't is any guide to all this. And don't ask me to volunteer for that one . . . I've got my hands full with cold fusion.

SPECIAL EVENTS

Number 25 on your Feedback card

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our BBS* ***(603-924-9343)****. for listings that were too late to get into publication.*

JULY 4

HARRISBURG, PA A Hamfest will be held by the Harrisburg RAC, 8 AM-2 PM (Set-up at 6 AM). Location: Bressler Picnic Grounds. Contact *Steve Gobat KA3PDQ, 1600 Old Trail Rd., Etters PA 17319; (717) 938-6943.*

JULY 8-10

GANDER, NF, CANADA The ARC of Central Newfoundland (ARCON) will host a Hamfest at Hotel Gander. Flea Market, Seminars. Banquet. Contact *ARCON, P.O. Box 281, Gander, NF, Canada A1V 1W6.*

JULY 9

SOUTH MILWAUKEE, WI The South Milwaukee ARC Inc. will hold its 25th annual "SWAPFEST" at the American Legion Post #434 grounds, at 9327 S. Shepard Ave., Oak Creek WI, from 7 AM-2 PM CDT. Talk-in on 146.52 WA9TXE/9 or phone *(414) 762-3235.*

JULY 9-10

INDIANAPOLIS, IN The Indianapolis Hamfest Assn. will host the ARRL Central Div. Convention at the Marion County Fair Grounds. Flea Market. Exhibits. Forums. Banquet. T-Hunts. Contact *Indianapolis Hamfest Assn., P.O. Box 11776, Indianapolis IN 46201. Tel. (317) 251-4407.*

JULY 10

BALTIMORE, MD The Maryland Hamfest/Computer Fest will be held at Timonium Fairgrounds on York Rd. Set-up 2 PM Sat., July 9th. Tailgating area opens at 6 AM Sun., July 10th; buildings open at 8 AM. VE Exams will be given at 10 AM only. Pre-registration is required. Call *Les McClure W3GXT, (410) 833-8667* to pre-register. Talk-in will be on 147.03 and 224.96 MHz Rptrs. For Hamfest info, call *(410) 467-4634;* or write *BRATS Hamfest, P.O. Box 5915, Baltimore MD 21208.*

PITTSBURGH, PA The 9th annual Hamfest of the North Hills ARC will be held 8 AM-3 PM at Northland Public Library, 300 Cumberland Rd. Flea Market. Seminars. Silent Key Estate Sale. Talk-in on 147.69/.09. Contact *Don Jackson N3LAZ, 915 Dale Ave., Bradford Woods PA 15015. Tel. (412) 935-3343.*

JULY 16

LANCASTER, PA A Computer and Electronics Show, sponsored by Red Rose Repeater Assn., will be held 9 AM-3 PM at McCaskey H.S. Set-up at 7 AM. Talk-in on 147.015+. Vendors contact *Larry Harman, Box 182, Leola PA 17540. Tel. (717) 656-0129. Fax (717) 656-3474.*

JULY 17

VAN WERT, OH The Van Wert County Fairgrounds Commercial Bldg. will be the location for a Hamfest sponsored by Van Wert ARC (W8FY). Time: 8 AM-4 PM. Talk-in on 146.850. VE Exams, pre-register by July 10th: Contact *Bob High KA8IAF, 12838 Tomlinson Rd., Rockford OH 45882; Tel. (419) 795-5763 (before 5 PM.* T-Hunt. Hamfest. For info. call: *Bob WD8LPY, (419) 238-1877, after 5 PM.*

JULY 24

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01 111th St. Doors open 9 AM. Set-up at 7:30 AM. Contact (at night only), *Charles Becker WA2JUJ, (516) 694-3955;* or *Arnie Schiffman WB2YXB, (718) 343-0172.* Talk-in on 444.200 WB2ZZO/R, or 146.52 simplex.

STICKNEY, IL Hamfest '94, sponsored by the Dupage ARC, will be held at Hawthorne Race Course, 3500 South Cicero Ave. Flea Market. VE Exams and CW testing 9 AM-12 noon., walk-ins welcome. Please have your original license, a photo copy and a photo ID. For table info, call *(708) 985-9256.* For advance tickets, send SASE and a check payable to DARC to *Hamfest '94, 7511 Walnut Ave., Woodridge IL 60517.*

JULY 30

ASHEVILLE, NC The 19th annual Western Carolina Hamfest (ARRL sanctioned) will be held 8 AM-4 PM at Haywood County Fair Grounds (near Waynesville and Lake Junaluska). For Dealer and Flea Market info, contact *Miriam Smith KB4C, (704) 683-4251.* Get general info from *Dick Critchell KY2Y, (704) 299-7856.* Ticket contact is *Ray Crepeau WB1HGO, (704) 298-7289,* or mail an SASE to *WCARS, P.O. Box 1488, Asheville NC 28802.*

JULY 31

SUGAR GROVE, IL The Fox River Radio League will hold its annual Hamfest at Waubonsee Community College, Route 47 at Harter Rd. Open to the public at 8 AM. Set-up Sat. July 30th at 7 PM, and Sun. July 31st, 6 AM-8 AM. VE Exams at 10 AM. Talk-in on 145.470 (-600). Contact *Bill Schaben WA9AUW, (708) 208-4870;* or *Mark Hougaard KB9FCC, (708) 979-1717.*

AUG 1

DOYLESTOWN, PA The Wyndmoor AR Repeater Club of Doylestown will meet at the Doylestown Township Bldg. Community Room on Wells Road, at 7:30 PM. Interested persons may call *Bob Agans, (215) 348-7966.* The Club features speakers and videotapes on topics concerning amateur radio, and they get together to study for license tests, etc. They often schedule weekend excursions to ham radio events.

AUG 5-7

VERNON, BC, CANADA The 3rd annual Sky High Hamfest will be held by the North Okanagan RAC, at Silver Star Mt. Resort. Flea Market. Dinner & Dance. HF Station. More. Contact *North Okanagan ARC, P.O. Box 1706, Vernon BC V1T 8C3, Canada.* For hotel reservations, call *1-800-663-4431.*

AUG 6

INDIANAPOLIS, IN The annual WA9SNT Hamfest will be held at ITT Tech. Inst., 9511 Angola Ct., from 8 AM-3 PM. Set-up at 6 AM. This event is sponsored by the ITT Radio Club. Talk-in on 145.25-. Contact *Dave Johnston K9HDO, (317) 875-8640.*

VALPARAISO, IN The Porter County Hamfest and Computer Show, sponsored by the Porter County ARC in co-operation with The Porter County Tourism Bureau, will be held at Porter County Expo Center. Doors open at 8 AM (set-up at 6 AM). VE Exams 9 AM-12 Noon. Talk-in on 146.775/-6kc 131.8 PL and 146.520 simplex. Contact *Rich N9QLQ, (219) 762-8701;* or send SASE to *PCARC HamFest, P.O. Box 1782, Valparaiso IN 46384-1782*

AUG 6-7

JACKSONVILLE, FL The Greater Jacksonville Amateur Radio/Computer Show/ARRL Northern Florida Section Convention, will be held at Osborn Convention Center in downtown Jacksonville. Flea Market. Hours: 9 AM-5 PM Sat.; 9 AM-3 PM Sun. Set-up at 2 PM-6 PM Fri. and 7 AM-9 AM Sat. VE Exams Sun. at 9 AM. Contact *Greater Jacksonville Hamfest Assn., P.O. Box 27033, Jacksonville FL 32205. Tel. (904) 350-9193.*

AUG 7

CROOKED LAKE, ANGOLA, IN The Annual Land of Lakes Angola Hamfest, sponsored by the Land of Lakes ARC, will be held 6 AM-2 PM at Steuben County 4-H Fairgrounds, corner of 200W & 200 N. VE Exams for all classes. Talk-in on 147.180, 145.090 packet, 444.350 131.8 tone, 444.900/.100, 224.94, 53.050. Contact *Sharon Brown WD9DSP, 905 W. Pkwy. Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.*

MARSHFIELD, WI The Marshfield Area ARS will hold their 3rd annual Picnic, in Wildwood Park, beginning around 11 AM. This is a Potluck/Swapfest. Talk-in on 147.180. Contact *Guy A. Boucher KB9GPJ, 107 West Third St., Marshfield WI 54449. Tel. (715) 384-4323. PACKETT:KB9GPJ @ W9IHW.WI.USA.NA.*

NORTH TARRYTOWN, NY The Westchester Emergency Comm. Assn. (WECA) will hold their "WECA Summerfest 1994" at Westchester County Center, Junction of Rte 119 and Bronx River Pkwy. Talk-in on 147.06/.66. Vendors, Forums, VE Exams, and more. Contact *Jeanne Raffaelli, (914) 962-9666.*

PEOTONE, IL The 60th annual Hamfest/Computer Festival, sponsored by Hamfesters Radio Club, Inc., will be held at Will County Fairgrounds 6 AM-3 PM. Flea Market. Set-up Sat. Aug. 6th at 6 PM-12 midnight. Talk-in on 146.52 simplex, 146.64 (-) (courtesy of STARS); 146.94 (-) (courtesy of KARS). For info, call *(708) 535-AHAM.* Get advance tickets (SASE and check by July 20th) from *David F. Brasel NF9N, 6933 W. 110 St., Worth IL 60482. Tel. (708) 448-0580.*

SPECIAL EVENT STATIONS

JULY 3

RUSSIAVILLE, IN The Kokomo ARC will sponsor a Special Events Station honoring the Sesquicentennial celebration of Howard County. Operation will be on 80, 40, and 20 meters in the bottom 25 kHz of the General class bands, and in the 15 and 10 meter Novice class bands. The station will be on the air at 1400 UTC and will continue for 12 hours. Please QSL w/SASE to *Dick Elliot N9IPA, P.O. Box 128, Russiaville IN 46979.*

JULY 4

COEBURN, VA The Lonesome Pine ARS will operate 0300Z-2200Z to commemorate Coeburn's 100th Centennial Celebration. Operation will be SSB in the General phone portions of 10, 20, and 40 meters. For a certificate, please send a 9" x 12" SASE to the *Lonesome Pine ARS, P.O. Box 2955, Wise VA 24293.*

JULY 4-5

PLEASANTON, CA Livermore ARK will operate N6FQQ 1700Z July 4th-0100Z July 5th, to commemorate the Centennial Anniversary of the City of Pleasanton. The station will operate from the Alameda County Fairgrounds. Frequencies: CW 7.125; phone 14.250 and 28.485. For a QSL, send your QSL and SASE to *Eliot Ross WA6PYH/AG, 7005 Corinth Ct., Dublin CA 94568.*

WILLIAMSBURG, VA The Williamsburg Area ARC will operate W4TMN 1200Z July 4th-0100Z July 5th, to celebrate the 218th Anniversary of the signing of the Declaration of Independance. Frequencies: 146.58, 28.350, 24.950, 21.350, 18.150, 14.270, 7.270 and 3.870. For an unfolded certificate, send QSL and a 9" x 12" SASE to *Hershel Kreis KE4GWV, 145 Sand Hill Rd., Williamsburg VA 23188.*

JULY 4-10

AUSTIN, TX Amateurs affiliated with the American Sunbathing Assn., the Naturist Soc., and the Federation of Canadian Naturists, will observe the 19th annual North American Nude Awareness Celebration by operating a Special Event Station near 14.265, 21.365, and 28.465 +/- QRM. For a certificate, please send QSL and a 9" x 12" SASE to *Bob Redoutey KF5KF, P.O. Box 200812, Austin TX 78720.*

JULY 7

RUTLEDGE, GA Atlanta Chapter 49, QCWA, will demonstrate amateur radio on HF/VHF starting at 2 PM-9 PM, EDST, in support of the National Kidney Foundation of Georgia's annual "Camp Independence," for young transplant eligibles at Camp Twin Lakes. It allows young people to see and participate in amateur radio communications. Frequencies: 7250, 14250, and 21,250 +/- QRM, using W4NZJ. All contacts welcomed and invited. For a special QSL card, please send your contact info and QSL card w/SASE to *Judson F. Whatley W4NZJ, 2156 Windsor Dr., Snellville GA 30278.*

JULY 7-9

PITTSBURGH, PA Station WA3BAK will be on the air Thurs., Fri., and Sat., July 7th-9th, 09:00 to 23:00 hours, in conjunction with the 56th annual Soc. for Preservation and Encouragement of Barber Shop Quartet Singing in America (SPEBSQSA) Intern'l Convention. Frequencies: 20 me-

ters - 14.225/.245 MHz; 15 meters - 21.300/320 MHz. 10 meters - 28.300/.320 MHz; 2 meters - 146.610 -600 kHz; 220 MHz band. 224.00 -1.60; 440 MHz band. 440.000 -5 MHz. Packet: W3HID @ W3IXR.#SWPA.PA.USA.NA Bob Schlesinger is Anchor Operator. All QSOs will be confirmed by a special commemorative QSL card, courtesy of Yaesu. USA QSL cards are available to WA3VBAK SWL's who send a SASE to *Barber Shop Singers, 4952 Esther Dr., San Jose CA 95124 USA.*

JULY 9

EAST GREENWICH, RI The Fidelity ARC will operate K1NQG from 1300Z to 1800Z, to coincide with the annual Yankee Tune Up at the New England Wireless and Steam Museum. Operation will be: Phone—lower portion of the 20 meter General subband; CW—Novice portion of the 40 meter band. For a certificate, send QSL and SASE to *Bob Ritoli NE1E, P.O. Box 168, 8 Locust Ct., Fiskeville RI 02823.*
EASTON, PA The Delaware-Lehigh ARC will operate W3OK 1200Z-2400Z from the Canal Festival. Operation will be on 3.965, 7.265, 14.265, 21.365, and 28.365 MHz. For a special QSL, send QSL, Contact number, and SASE to *DLARC RD 4, Greystone Bldg., Nazareth PA 18064.*

JULY 9-10

FULTON, NY Station KY27 will be operated 1200Z-2100Z each day from the Spirit of Central New York Hot Air Balloon Festival and Air Show at the Oswego County Airport. Sponsor: The Oswego AR Emergency Service. Operation will be in the middle of the General 80, 40, 20, 15 and 10 meter phone bands; the Novice portion of 10 meters, and 147.75/.15 MHz. For a certificate, send your QSL card and a large SASE to *Fred Swiatlowski KY2F, P.O. Box 5227, Oswego NY 13126.*
ST. LOUIS, MO The Monsanto ARA will operate WB0BBN from 1300 UTC-0300 UTC (both days), to commemorate the St Louis Gateway to the Gold 1994 Olympic Festival closing. Operation will be in the General portion of 40, 20, and 15 meters, the Novice portion of 10 meters. 147.36+, 224.98-, and 443.55+. For a special QSL, please send a 9" x 12" SASE for an unfolded QSL, or a legal size SASE for a folded QSL, to *M.A.R.A., P.O. Box 1596, Maryland Heights MO 63043.*

JULY 21-30

EDMONTON, ALBERTA, CANADA The Radio Amateur Educational Society will operate VE6KDA during the annual Klondike Days Exposition. Frequencies: 1.870 when conditions permit, 3.750 0200 UTC-0500 UTC; 7.2000 2300 UTC-0200 UTC; 14.165, 21.220, 28.300, and 14.050 (CW) when conditions permit. For a QSL, send QSL and SASE to *RAES, Ritchie Postal Outlet Box 75038, Edmonton AB T6E 6K1, Canada.*

JULY 23-24

PENANG, MALAYSIA The Malaysian AR Transmitter Soc. will sponsor a CW Contest 0001Z Sat. July 23rd-2359Z Sun. July 24th, as part of an invitation for hams to visit Malaysia and attend the "SEANET 94" Convention in November. Operation will be on 160, 80, 40, 20, 15, and 10 meters (no WARC bands). The Contest call is "CQ SEA." Contact *Seanet Contest Manager 1994, Eshee Razak 9M2FK, P.O. Box 13, 10700 Penang, Malaysia.*
STRATFORD, NY The Fulton County Mahlon Loomis Committee will operate W2ZZJ from 1300Z-2000Z on the General class phone portion of 40, 20, and 15 meters, and on the Novice 10 meter phone band, to celebrate the 168th Anniversary of the birth of Dr. Mahlon Loomis, the American wireless telegraphy pioneer For literature and a certificate, send QSL, contact number, and a #10 SASE to *W2ZZJ, 5738 STHWY 29A, Stratford NY 13470.*

JULY 25-31

CANTON, OH The Canton ARC will operate W8AL to celebrate the Pro Football Hall of Fame Greatest Weekend. Time: 1400 UTC-0200 UTC. Frequencies: SSB - 28.350, 24.950, 21.350, 18.150, 14.270, 7.270, and 3.870 MHz; CW - 28.125, 24.910, 21.125, 18.080, 14.050, 10.120, 7.125, and 3.700 +/- QRM. There will also be RTTY, Packet, AMTOR, Satellite, 2-meter and 6-meter FM/SSB. SWLs are welcome. For an unfolded certificate, send your QSL with contact number and a 9" x 12" SASE, with two units of first-class postage. For a QSL or a folded certificate, send your QSL with contact # and a #10 (business size) SASE to *Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306.*

JULY 30-31

DANBURY, CT The Candlewood ARA and its members will sponsor the 1994 Connecticut QSO Party from 2000Z July 30th-2000Z July 31st, with a rest period 0400Z-1200Z. Get details from *Frank Etzler N8WXQ, (203) 350-3523*

AUG 5-7

MILWAUKEE, WI Members of the Milwaukee ARES will operate Station W9WK to celebrate the 4th annual "Picnic Ham" held at Menomonee Park in Lannon WI. Operation will be in the General phone and CW bands on 75, 40, 20, 15 and 10 meters. For a certificate, send QSL and a 9" x 12" envelope (with 2 units of postage) to *W9WK, c/o John Leekly, 757 N. Broadway, Suite 306, Milwaukee WI 53202.*

AUG 6-7

BARNEGAT LIGHT, NJ The Old Barney ARC will operate W2OB from "OLD BARNEY," the Barnegat Lighthouse (Long Beach Island IOTA NA-111), to commemorate National Lighthouse Day. Time: 3000 UTC-0000 UTC each day. Frequencies: Look in the lower 25 kHz of the General phone bands; 40, 20, 15, and 10 meters, plus 146.52 simplex, 146.835 Rptr., and other local Rptrs. For a special QSL, send a 9" x 12" SASE with 2 units of postage, via NU2F. For more info, contact *QSL W2OB via NU2F, Joe Fleishinger Sr., 75 Joshua Dr., Manahawkin NJ 08050 USA.*

AUG 7-13

POTTSVILLE, PA The Schuylkill ARA will operate N3ILC Aug 7th-Aug 13th, to celebrate the Schuylkill County Fair. Operation will be both CW and phone on the General and Novice subbands. For a certificate, send QSL and SASE to *Ed Brennan N3ILC, 520 Spring Garden St., Pottsville PA 17901-1651.*

RANDOM OUTPUT

Continued from page 88

got a big laugh around the office, since I'm so conservative I make Rush Limbaugh look like a "New Dealer."). I also got accused of being a fascist. One angry gent who didn't have the courage to give his return address wrote to Wayne instead of me and said I must be a new ham, since I didn't know the first thing about radio or regulations, and that I should not be allowed to write any more columns (for the record, I've been licensed for 21 years). Go figure.

At the very least, I expect the same respect from you as I give. I do not write down to you, nor do I assume that you are all ignorant. I do not care how long you've been a ham, nor do I assign any prestige or instant authority to any particular class of license. If you're going to bother to write to me, please have a little respect for yourself *and* me. We can disagree, but let's remember to use logic to make our points, not insults.

All I did was suggest that we give some thought to why we find it necessary to carry around radios capable of transmitting on police and other public service frequencies. I wanted you folks to *think* about it. If you feel threatened by that, then I suggest you probably need to do a lot more self-examination on this issue than the rest of us.

As always, I appreciate every single letter that comes in. I don't care if you agree with my opinion as long as you actually have one. Having an opinion means more than just a knee-jerk reaction to something that offends or threatens your belief systems. It means taking all of the available input and forming *your own* ideas. It's not difficult and you don't have to be a college graduate to do it, but it does take effort. Mental effort.

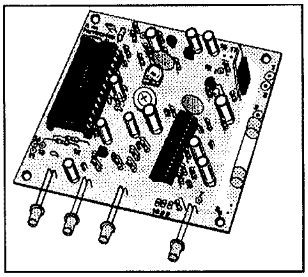
Number 27 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

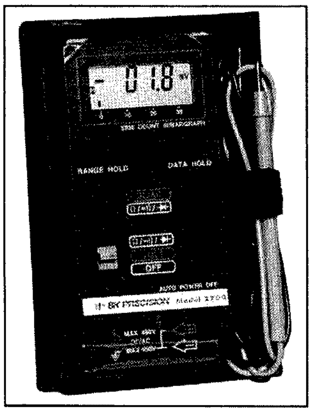
HAMTRONICS

Hamtronics has announced the new COR-6 module—a voice ID repeater controller combining COR circuits and a real-voice ID on one board. It can be used with transmitter and receiver modules to make a simple, low-cost repeater.



A digital IC records up to 20 seconds of your voice, using audio from the repeater receiver. The unit includes tail and time-out timers, courtesy beep, and a solid-state relay to key the transmitter.

The kit price is $99, or the unit is available wired and tested for $149. A catalog is also available. For more information contact *Hamtronics, Inc., 65-F Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.* Or circle Reader Service No. 202.

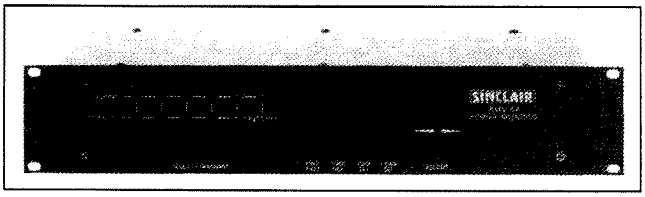


B+K PRECISION

B+K has introduced their first digital multimeter that is truly pocket-sized—the instrument is only 4.4" x 2.2" x 0.4" and weighs only 3.5 ounces with batteries. The Model 2700 DMM measures AC and DC volts and resistance, with data hold, range hold, audible continuity test, diode test, bar graph, and 3200 count LCD display.

Data hold freezes the display to hold a reading. Range hold allows the user to defeat autoranging and select one specific voltage or resistance range for all measurements. This is the only pocket DMM to offer all these features.

For more information, visit your favorite dealer or contact *B+K Precision, 6470 W. Courtland St., Chicago, IL 60635; (312) 889-1448, FAX (312) 794-9740.* Or circle Reader Service No. 204.

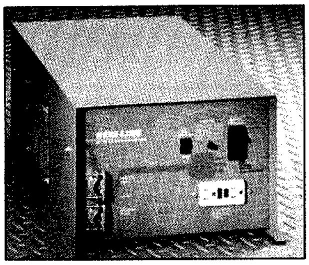


SINCLAIR RADIO LABS

Sinclair Radio Labs has introduced an intelligent site monitor for remote RF transmitters and associated antenna equipment. The AMV-6A measures RF power from 1 to 990 watts in both the forward and reflected mode simultaneously, allowing for easy VSWR calculations.

Near intuitive setup and programming make this power monitor simple to use, and no computer or other ancillary equipment is required for installation. The unit allows system power and VSWR tests without disconnecting coax lines.

For more information contact *Sinclair Radio Laboratories, Inc., 675 Ensminger Rd., Tonawanda, NY 14150; (716) 874-3682, (800) 288-2763, FAX (716) 874-3682.* Or circle Reader service No. 206.



PACIFIC SCIENTIFIC

The same commercial duty reliability found in Redi-Line mobile electric generators is now available in an electronic inverter to meet your portable power needs. The Redi-Line model DA12I-2400Q solid-state inverter operates from 12 VDC vehicle batteries to run 120 VAC, 60 Hz equipment wherever commercial power is not conveniently available.

The new Redi-Line inverter will operate sensitive electronic equipment requiring a regulated output, including personal computers, and is ideal for equipment requiring up to 2000 watts (continuous), 2400 watts (for up to 15 minutes), and surge output of up to 5900 watts, for loads like heavy-duty power tools with high starting currents. Power conversion efficiency is between 85-93%.

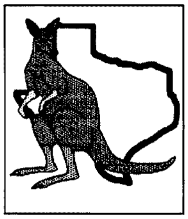
A brochure with specifications and other practical information is available for $4 to cover shipping and handling. For more information contact *Pacific Scientific, Inquiry Handling Department, 1084 Old Colony Road, Lake Forest, IL 60045; (815) 226-3100, FAX (815) 226-3080.* Or circle Reader Service No. 201.

TIARE PUBLICATIONS

Work the world with 1 watt! Make contacts of over a thousand miles using just milliwatts! That's just a sample of the fascinating fun you can have with the new book *Low Power Communications - Volume 2 - Advanced QRP Operating.*

Conceived, coordinated, and edited by Richard H. Arland K7YHA, the book's eight chapters were written by some well-known QRPers, including *73's* own Mike Bryce WB8VGE. Chapters cover: QRP DXing, contesting, satellites, antennas, solar power, micro- and milli-watting, and DXpeditioning on a QRP budget.

The book is illustrated, and is priced at $19.95. It is available from your favorite dealer, or order direct from Tiare (add $2 USA, $3 elsewhere for S & H). For more information contact *Tiare Publications, P.O. Box 493, Lake Geneva, Wi 53147; (800) 420-0579, (414) 248-4845.* Or circle Reader Service No. 203.



KANGAROO TABOR SOFTWARE

Kangaroo Tabor Software has announced the new CAPMAN 2.0 computer-assisted prediction manger. This is a professional-quality IONCAP package that allows anyone to use the most advanced propagation routine interfacing with the ELNEC and MININEC antenna analysis gain patterns.

CAPMAN is the versatile menu-driven skyway analysis package developed by Kangaroo Tabor Software and the prime author of IONCAP. CAPMAN delivers IONCAP input file construction and management, two integrated execute functions: the ability to view and manipulate huge output files, and graphical display of output parameters for multiple target locations and time periods.

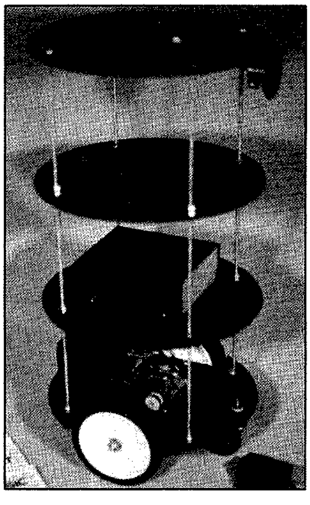
This product contains a full-featured location database and can be easily customized. The CAPMAN package requires a 386 or better PC or compatible. The IONCAP program is included in the CAPMAN package, which is priced at $89 ppd. in the USA (elsewhere add $3.50 S & H). For more information contact *LUCAS Radio/KangarooTabor Software, 2900 Valmont Rd., Suite H, Boulder, CO 80301; (303) 494-4647, FAX (303) 494-0937.* Or circle Reader service No. 205.

ACLYPSE CORPORATION

Aclypse Corporation has announced the ADR-1 Robot Kit, a little something different for the ham who has everything. The robot is 27" tall x 14" in diameter and weighs 16 pounds. The complete kit has an onboard computer system that features voice recognition capabilities, English speech output, power motor drive, and a battery with monitoring and recharge system.

No electronics or advanced computer experience is required. Construction takes two to six hours and requires no special tools. The robot has its own operating system and a BASIC programming language is built in. The complete kit is priced at $299.

For more information contact *Aclypse Corporation, Rt. 2, Box 213H, Worthington, IN 47471; (812) 875-2852, BBS (812) 875-2836.* Or circle Reader Service No. 207.



Number 28 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

I'm Back!

You thought you'd gotten rid of me, didn't you? You thought, "Cassidy has finally stopped beating his head against the wall and given up," didn't you? Ha, Ha Ha . . . No such luck!

Actually, an overwhelming number of readers called or wrote, demanding that I break the self-imposed silence and resume writing this column (OK, OK, it was only 12 letters). To that brave dozen go my heartfelt thanks. If you're wondering why I took a few months off, it's simple. One, I was trying to put together the Amateur Radio Child Search organization that I wrote about back in February (more on this later). Second, I simply ran out of things to say. Sure, I could have put together a couple of puff pieces to get me over the last few months, but frankly I have more respect for you than that. Judging from my mail, most of you who read "Random Output" at least have a pulse. Many of you can actually write a decent letter and form a logical argument, either agreeing with me or disagreeing with me (more on this later, too). I figured you would be able to tell that I was spinnning my wheels so, unlike many of the writers in this field (no names mentioned, please), I simply decided to say nothing, since I had nothing to say.

I don't write this column to feed my ego (contrary to what some of my critics say). I write this column because I think ham radio ought to be more than chasing DX and giving out signal reports. I think hams should be involved and concerned about their hobby and about the world around them. I try to send out sparks in this column, and hope that at least one person will give some thought to whatever topic I bring up. I don't want you to agree with me, but I do want you to think and develop *your own* opinion about things. If nothing else, I hope my column can provide something to talk about during a QSO, other than the make and model of your store-bought rig.

Amateur Radio Child Search

To pick up where we left off a few months ago, you'll recall that I requested those of you who were interested in assisting in the formation of Amateur Radio Child Search to drop me a note so I could gauge whether or not the idea could get off the ground.

I received three letters telling me why I shouldn't even try to do this. I think you can figure out where I told those naysayers to go. I received a phone call at my home on a Sunday afternoon, and the caller got angry with me when I suggested that it would be more appropriate if he contacted me during business hours at my office. I even received a call from a high-level employee of a well-known national service organization, outlining a possible funding source. I asked him to send me some info so that I could prepare a proposal for his organization, but he never did. I don't have this gentleman's phone number (I know, that's *my* fault), so that avenue turned into a dead end (at least so far). That was disappointing, because a single source of funding would have made this idea an immediate reality. I was (and am) willing to do all the organizing work, travel, and whatever else it takes to get this going, but a commitment of funding from a major organization sure would make it a lot easier.

When you take out the flakes, kooks and nuts, I received approximately 60 responses from people all across the country, pledging their support. Over 100,000 people cast their eyes upon these pages every month (if you believe the research that shows most magazines are read by at least two people). Even if you only take our paid circulation figures, at least 50,000+ people had the magazine in their hands. Sixty responses out of 50,000 people is not what I would call an overwhelming outpouring of support. In fact, I'd call it downright embarassing.

To those who responded, I regret to tell you that it doesn't look like this idea is going to get off the ground. I would urge you to think about forming a local group, or making it a club service project to contact local law enforcement and set up something like what I suggested. You don't have to make it fancy. Just be prepared to provide an organized and trained search group for whenever your local law enforcement agency needs it. If you need my help, give me a call (at my office, please). I am keeping a database of all of you who wrote to me. If a funding source *does* present itself, I'll be in touch.

Out-of-Band Radios

My column on the use and ownership of radios capable of out-of-band transmissions generated the most response of anything I've written in the last three-and-a-half years. Unfortunately, the reading comprehension level of some people isn't what it should be. Either that, or many of you didn't bother to read the whole article (the fact that the closing paragraph of my original text got chopped off without my knowledge didn't help, either).

Many of you sighted the regulations giving us permission to use any means at our disposal to save life or property. Many of you simply thought I was trying to confiscate your radios. I got accused of being a socialist (which

Continued on page 80

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

As I write these words (late April), the month of July does not look particularly good for HF band propagation. There are several reasons for this: generally declining sunspot activity; higher daytime absorption of signals during the summer; probable violent magnetic field storms which would adversely affect the ionosphere, hence HF band propagation during several days surrounding the 10th, 16th, and 29th; and possible other geophysical events such as hurricanes, volcanic eruptions and earthquakes. That is not to say they *will* occur, or that—if they do—they will happen in the U.S.A. However, my records taken over a period of about 16 years indicate a very high probability of such events taking place when the sun's disturbances cause strong magnetic field disruptions on earth.

On the positive side of the ledger, it is interesting to note that when HF bands are the poorest, the VHF bands are often the best . . . and that can happen during this month. There will be meteor shower propagation (delta Aquarids peaking on the 29th), and a possibility of strong auroral and sporadic E ionization on or around the dates given above. Sporadic E propagation via fast-moving ion clouds often results in short contacts on 10, 6 or 2 meters with very low path loss and high signal levels.

The band-by-band situation looks very much like last month's forecast.

10 and 12 Meter Bands

Sporadic E during daylight hours on many Good days (G), with strong skip signals from 500 to 1,500 miles, and with abrupt termination of contact as the ion cloud moves out of range.

15 and 17 Meter Bands

Good sporadic E contacts between 300 and 1,300 miles on most Good (G) days. Also, you may find trans-equatorial skip into the Southern Hemisphere, with decent but not outstanding signal strength.

20 Meter Band

Consistent DX to most parts of the world on Good (G) days during daylight hours, and on particularly favorable days, often until midnight local time. This band will be your DX workhorse.

30 and 40 Meter Bands

Nighttime DX between local sunset and sunrise ought to be good-to-excellent on days marked Good (G) on the chart, and often on Fair (F) days. Thunderstorm activity usually abates several hours after sunset, but ORN will obscure weak signals. Day and night short skip will occur on many days, with daytime skip averaging up to 1,000 miles and nighttime skip up to 2,000 miles. Beware of high absorption levels around local noon.

80 and 160 Meter Bands

Forget any daytime activity, but when conditions are Good (G) you may well discover occasional DX at night, especially when ORN from thunderstorms isn't present. There will be few, if any, really good DX contacts on 160 or 80 during July. Short skip at night, however, can be pretty good out to about 1,000 miles or so.

Always listen to WWV and the propagation forecasts at 18 minutes after any hour, when up-to-date reports of Boulder K and A indexes are given along with solar flux readings.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40*	40		15	15	15	10	10
ENGLAND			40*	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40*	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40*	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
USSR							20	20		20		
WEST COAST	20	40	40	40*	40*	40						20

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40*	40		20			20	
CANAL ZONE	15	20	20	20	40	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40*	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40*	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
USSR								20			20	

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40*	40*		20		15	15
CANAL ZONE	15	15	20	20*	40	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20*	40*	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20	40*	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20	40*	40		20	20	15	15	15
SOUTH AFRICA			40						20			
USSR									20			
EAST COAST	20	40	40	40	40	40						20

* = Possible 80 meter openings. * = Check next higher band. G = Good F = Fair P = Poor

JULY 1994

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P-F	2 P-F
3 F	4 F	5 F-G	6 G	7 G-F	8 F-P	9 P-VP
10 VP	11 P	12 P-F	13 F	14 F-P	15 P-VP	16 VP
17 P	18 P	19 P-F	20 F-G	21 G	22 G-F	23 F
24 F-G	25 G-F	26 F	27 F-P	28 P	29 P-VP	30 VP
31 VP						

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August 1994
Issue #407

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FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: Time to heat up the soldering iron and get into a 73 construction project! (Photo by David Cassidy N1GPH.)

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Fan or Fanatic?

I've known several hams whose wives divorced them, naming amateur radio as the correspondent. Look, this is supposed to be a hobby! I know many DXers who stay home from work when there is a new country on the air. I know repeater nuts who have an HT with them day and night, tuned to their repeater.

There have been some times in my life when I've gone overboard hamming. I would spend my afternoons building equipment, my nights operating, and my mornings sleeping. I was so busy hamming that I didn't have time to land a job. I lived happily on my unemployment payments. The positive side was that I sure built a lot of stuff. I had the whole cellar packed solid with steel shelves of ham equipment. I had so much stuff I'd built, and so many parts for building, that when I decided to move to New Hampshire in 1962 it took five truckloads to move everything. I'd kept the stuff beyond what my cellar could hold in several nearby rented garages.

I had a 75m AM kilowatt, another all-band PP-813 kilowatt, an SCR-522 with a surplus kilowatt amplifier on 2m, about 50 watts on 6m with another converted 522, all kinds of Teletype and test equipment. I worked DX. I was active in most of the major contests. I worked RTTY, NBFM, AM, aurora on 2m, and so on. I had tons of fun doing it.

This all turned out to be solid gold for me when I unexpectedly found myself the editor of *CQ* magazine. All that time spent on my background suddenly was useful. Indeed, I couldn't have done the job if I hadn't invested all that time in the hobby.

But outside of gunning for the thankless job of editing a ham rag, the total devotion of your life to amateur radio is dumb. I don't doubt for one minute that there really is a special place in heaven for rabid DXers. I just happen to think that it is well padded. There are probably well-padded cells for our other fanatics.

Mind you, I have no quarrel with hams working DX, as long as it isn't actually important to them. Working DX and earning a place on the ARRL Honor Roll is fine, as long as it isn't important. I got up somewhere over 300 countries worked and slopped counting. I had great fun pioneering NBFM and then SSB. I had fun with SSTV, when that got started. And RTTY. I loved learning and doing. It was wonderful fun exploring 10 GHz and working seven states from my little hill in southern New Hampshire. I've enjoyed competing in just about every contest the ARRL has come up with. In retrospect, I can't think of any amateur radio activity that I regret having investigated. And there aren't many I've missed. But I've never let the hobby become an obsession, and I've never had one word of complaint from my wife about my ham activities.

It's a hobby. It's for fun. So get the most out of it you can. Think about it—are you in a rut? Are you just getting on the air and gassing with the same 75m crowd endlessly? I tried that for a couple of years and got over it. Oh, I had some wonderful time with W1MLJ in Barre (VT), W1IF, Bill and Olga, in Peabody (MA), and Homer W1KPL in Jaffrey (NH). But that didn't keep me from mountaintop expeditions on 2 meters, from racking up a fair DX score, or winning sweepstakes contests for my section.

How come you haven't put up an antenna and tried some satellite contacts? What's the matter with you? It's a ball!

Tried Rallying Yet?

Have you ever, as a ham, provided communications for a local sports car club putting on a rally? You and your ham club can have a ball—just offer your services to car clubs, or even to the Sports Car Club of America (SCCA), which organizes the national rallies.

For that matter, if you haven't ever gone on a rally, you've missed a lot of fun. A bunch of us hams around Brooklyn (NY) used to go on rallies just about every weekend. And you don't have to have a sports car to do it, though it's more fun in a sports car.

There are a lot of different kinds of rallies, but the ordinary garden variety rally consists of from 10 to around 100 cars, each with a driver and navigator team, driving over ordinary roads and highways, and at below the speed limit, following a set of sometimes tricky route instructions.

The cars paste large numbers on their sides so the people at the checkpoints can identify them, and are started at one-minute intervals. The organizers give the teams the route instructions one minute before blastoff. These are called time-speed-distance (TSD) rallies. The instructions give the speed to be driven over each segment of the rally, and usually provide fairly simple instructions for making turns and speed changes.

Saturday morning rallies are often short, running perhaps 75 miles. A weekend rally can cover several hundred to over a thousand miles. On busy rally weekends I used to be able to go on a Friday night rally, another Saturday, and still a third on Sunday. There were a ton of rallies around Long Island.

Every few miles there is a checkpoint—usually hidden. They time you as you pass, usually taking one point off your score for every 1/100th minute early or late. That's about a half second.

The winners are seldom off more than one point per checkpoint on the average. This means, if you have any serious intention of winning, you have to be able to measure your mileage down to a hundredth of a mile, and your time to the hundreth of a minute. Then the navigator, in addition to helping the driver find turns and speed-change locations (change average speed to 35.71 mph at the Wishing Well sign), also has to run a calculator or computer and let the driver know what his odometer should read when the watch's second hand is straight up.

In most sports cars fitted for rallies the hundredths odometer and a stopwatch bracket are mounted on the dash so the driver can see them at a glance. The navigator reads off the instructions and computes. This is no job for anyone who tends to get carsick!

There are little complications which affect the calculations. Since no two cars have odometers that read exactly the same, in order to match your speed with that of the car used to lay out the rally, you need a mileage check. This is usually at 10 miles out. When you reach the point where the official car's odometer reads 10 miles you see what your odometer reads, and from then on you have to correct all of the instruction average speeds to take this difference into consideration. Hey, if it was easy, it wouldn't be so much fun. To win rallies you have to be a precision driver and a navigator who makes faultless calculations on the run and under pressure. If you get hung up in traffic or by stoplights you have to get back on schedule as quickly as possible. There's nothing like getting stuck behind a little old lady on a back country road to cause stress. Tough.

Most rallyists have a shortwave converter to pick up the time signals from CHU or WWV, just to make sure their watch isn't a half second off after a few hours bumping along on back roads.

Hams can help car clubs by helping work the checkpoints and then radioing in the points lost by each team to the finish line. That makes it possible to determine the winners much faster. Without radios, the checkpoint people have to drive to the finish with their scores, and then the organizers have to total them up. With many rallies having a dozen or so checkpoints, this can take awhile. It's better to get the results announced quickly and hand out the trophies so everyone can go home and get some rest.

I was reminded of this the other day when I was out in the barn looking through some boxes and came upon a couple cartons of old rally trophies. The silver is a little tarnished now. I should polish 'em up, I suppose. Back in 1958, when I bought my Porsche Speedster, I got involved with rallies, and I enjoyed them until I moved to New Hampshire in 1962. There's not much in rallies up here in the mountains and I miss 'em.

They've probably got some great computers for TSD these days. Thirty years ago most of us used the Curta calculators. They were made in Liechtenstein and looked like pepper grinders. They were made for currency calculations, but they were ideal for rallies. I liked 'em so much I went to Liechtenstein and became an importer. I found the very best rally watches (Hanhart) in Schwenningen, Germany, and imported those too. I had quite a good importing business going selling rally equipment—including my own special speed tables, which beat the heck out of any others.

I wonder if Walter Cronkite remembers coming to my house in Brooklyn to buy a Curta calculator? He used to be big on rallying—until he and his navigator ended up in a lake one day.

You might want to try some local car rallies and see how much fun they are. Who knows, if you get addicted you might go for a Miata, they're so reasonable. They're the closest thing there is to the good old Porsche Speedster. In the meanwhile your club members can have a lot of fun helping local car clubs with their checkpoints and getting scores in early.

Poisoning Little Minds

One of the things that helped suck

Continued on page 82

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Bill Haddad WD9HXH, Whiting IN I wonder how many of the old geezers of our hobby really know how slow their CW communications is compared to modern technology. Perhaps I can get their attention with my own experience. Back in 1942 as a radio operator in the Navy Department in Washington, DC, my first assignment was to monitor the FOX broadcast. This was an 18 wpm CW broadcast to all ships at sea. This broadcast operated 24 hours a day, seven days a week.

I began to wonder how many words I would have sent at that speed in the 50-some years since leaving the Navy Department. I put this on my calculator and found that in 50 years I would have sent 473,364,000 words. At today's 155 megabits per second, *all* of those 50 years of sending could be transmitted in 3.38 minutes. Need I say more?

Paul A. Robertson N2XZF, Rochester NY *[Letter to Steve Katz WB2WIK/6]* With reference to your excellent article on building a half-gallon amplifier in the April 1994 issue of *73 Amateur Radio Today* (page 40), I would like to add a strong admonition about the insulation material used on the tube featured. The material is *beryllium oxide,* an extremely toxic substance if inhaled. It is benign if left undisturbed, but can cause problems if proper precautions are not observed. Possibly we are lulled into a sense of security by the appearance of this material because it looks like plain old ceramic. Not so!

The simple precautions are this: Do not abrade, fracture, or in any other way cause the material to become airborne. These precautions also apply to the insulation (ceramic) used on RF power transistors—you know, those ones that look like butterflies or helicopters.

Paul—Thanks for your nice letter. Yours was one of many letters I've received to date on this article, and the only one pointing out my oversight in not printing a warning regarding the hazards of contact with beryllium oxide, BeO.

You're absolutely right, BeO is horrible stuff. Fortunately, the tube itself doesn't use any (externally), it's only the thermal link which mounts between the tube and the heat sink that does. I did recommend that any potential user of a commercial RF deck get hold of a data sheet on the tube prior to doing anything, *and if you look at the Eimac data sheet on the 8560A tube referenced and shown in my article, it is absolutely loaded with hazard warnings! Thankfully, the thermal link sold by Eimac to go with this family of conduction-cooled tubes has such a polished surface that it would be extremely difficult to come in contact with any BeO powder, which, as you know, is the real hazard. (The polished surface is stabilized and quite safe to handle.)*

Another "fortunately" is: They've now gotten away from BeO in favor of aluminum nitride, which is nearly thermally as conductive and is completely safe to handle in any form. I see that the industry trend is to avoid BeO whenever possible and use aluminum nitride for electrical isolation and thermal conduction. BeO is still used inside a lot of electronic power components, including tubes, but it's pretty safe inside there. . . . Steve WB2WIK

Gene WØGLI and XYL Delia Twalt, Cylinder IA Wayne, this is just a short note to tell you that my XYL and I enjoyed reading the "Never Say Die" column in the February '94 issue. We are both interested in electromedicine and magnetic therapy. A friend showed us some magnetic pads produced by a Japanese company called Nikken. My wife is a long-term asthma sufferer and has showed improvement since she started using it.

George Gray WB2CHP, Spring Valley NY Wayne, In your otherwise exciting (as usual) "Never Say Die" for May, you included a remark indicating that you have fallen for the propaganda of such outfits as "Handgun Control, Inc." regarding the National Rifle Association, and I would like to try to disabuse you on this. The NRA is not some nut outfit refusing to allow criminals (who will never be disarmed) to be disarmed, but several million citizens who refuse to allow *victims* to be disarmed. (Let's not pretend that these anti-gun groups *only* want to outlaw some nebulous, undefined "assault weapons" [If I attack you with a golf club, is that an assault weapon?], they admit their ultimate goal is to outlaw *all* firearms!)

Let's look at what a wonderful world we could have if the NRA's lobbying failed and these anti-gun nuts had their way. The Colombian drug cartels could expand into smuggling guns and ammunition (increased employment), we could have hundreds of thousands of bathtub (all right, garage) shotgun and ammo makers (big cottage industry), half a million ATF agents making raids similar to the ones in Tulsa or Waco (more increased employment plus a reduction of the surplus population). Every college student will have to carry a pistol in his hip pocket (remember Prohibition?), and organized crime will get another big boost. More increased employment!

Of course there is a downside. Massacres such as the LIRR shooting (notice how effective New York's gun laws are; no one else on the train was armed!) would become commonplace, armed robbery would become *very* commonplace, and we would become subject to coups by the armed forces any time they did not like the way the government was handling some specific problem. (No one would have the power to oppose them.)

So maybe the NRA's lobbying is not having a bad effect on our quality of life, but is an attempt to keep it from deteriorating further!

George—I'm deeply disappointed in you. If you've been reading my editorials for any length of time you should know that I don't "fail" for any propaganda. I do my homework and think for myself . . . even about guns.

George, there are nuts on both sides of the gun arguments. I believe I've read and heard all sides, to the extent that I haven't seen a new idea from either camp in a long time. It's the same old crap both ways.

You are probably 100% right. We should allow kids of any age to take guns to school and kill each other when they get mad . . . or even slightly irritated. Even assault guns. We can always have more kids, and teachers are cheap. That's the easy part. I doubt we'd have any problem keeping our population up, but even if we did see it dropping a bit illegal immigration would take up the slack, and that means still more gun customers and money for the industry.

The survival of the fittest is nature's way, right? If everyone on the LIRR train had been armed, the surviving passengers could have blasted the guy out of his shoes after he emptied his first clip. Of course, you might also blast the little old lady who pushes in first when the door opens and grabs the seat you were heading for. That'll teach her a lesson. Just blow away one of her knees so she won't be so dammed fast next time.

So let's keep importing those assault rifles and cheap handguns. It'll make everyone a lot more polite. It'll also help the sale of bulletproof glass for cars.

George, my approach is every bit as reasonable as yours. America has the world's record for murder with guns and I say let's go for double or nothing. Cheers . . . Wayne

Al Margheim, Cumberland TX Wayne, I received the May 1994 issue of *73* on the same day I received my subscription renewal reminder for *73*. I was still considering whether to renew my subscription or not when I read your editorial. I noted with approval your comment on page 4 that you always do your homework before you write. Then I read your sarcastic comment on page 92 about the National Rifle Association, and you blew your credibility completely. Had you really done your homework on the National Rifle Association you would never have made such a statement.

I suppose your opinion of the NRA is based on what you've read or heard in the popular media, but you should know that the media often presents only one side of an issue. It is a fact that the media has been engaged in a smear campaign against the NRA for many years. Almost everything about the NRA in the major news publications and on TV is either incorrect or twisted in some way to make the NRA look bad. (I do not believe the NRA is beyond criticism; however, their lobbying efforts have benefited the citizens of the United States of America far more than any other organizations that I know of.

I have a challenge for you. I've renewed my subscription for one year. In the next year I want you to tell us in one of your editorials how the lobbying efforts of the NRA have damaged the quality of our lives. I expect you to make statements of fact, not opinion. If you won't address this in an editorial, then write me a personal letter. Then I'll write to you again and respond with facts refuting your statements. If you don't respond in some way, this will be my last year reading *73*.

If you are truly interested in doing your homework, I suggest you contact the National Rifle Association for their side of the story. I also *strongly* suggest you read *Point Blank: Guns and Violence in America* (Aldine, 1991) by Gary Kleck. Gary Kleck is a respected criminologist with Florida State University. His book was awarded the Hindelang Prize by the American Society of Criminology as the most important book written in the last three years. His studies show that America has benefited greatly from our system of firearms ownership.

If you care what the Constitution says, and what the authors of the Bill of Rights intended when they included the Second Amendment, you should also read the scholarly work *That Every Man Be Armed—The Evolution of a Constitutional Right* (The Independent Institute) by Stephen P. Halbrook.

Al—Here we are in an almost totally religious controversy and you are demanding facts? Having read all of the arguments on both sides, I can understand the people who believe that kids of six should be allowed to carry loaded guns to school; who believe that criminals are the problem, not guns. I can understand that they believe that kids should be able to take live hand grenades to school, and be allowed to handle deadly poisons and flame throwers.

After all, they say, don't we really have more population than the world can handle already? Darwin says it's the survival of the fittest, and we can see that our socialist namby-pamby government has gone to lengths to protect the unfittest. A few more guns, grenades, and assault weapons and some napalm in the right places might just be a good thing. Right? Once we all agree that everyone is entitled by the Constitution to carry arms anywhere they want, we are infringing on their rights if we want to prevent them from owning a tank or a dive bomber. Or an atom bomb, for that matter. It's a right, and never mind that this made sense a couple hundred years ago when it was written, but might just be a wee tad out of date now, considering technological advances in weaponry that were never imagined when our country was formed.

I guess it all depends on what kind of a society you prefer to live in. You want one where everyone is armed and ready to avenge any slight with any weapon on up to an atom bomb. And it makes wonderful TV shows, and it's all real.

So much for the religious part of our program. Now, I'm polishing up my Weatherby 300 and my Winchester 30-30 for some real action. Weatherby was a ham operator, by the way. I got my gun directly from him. I can whack a deer from 500 yards. Cheers . . . Wayne

Wayne Green: Coast-to-Coast

73 Publisher Wayne Green W2NSD/1 will be the featured guest on *Ham Radio & More*, a nationwide broadcast band talk show hosted by Len Winkler KB7LPW, on August 14, 1994.

The program is carried by 23 stations nationwide on the Talk America Network on Sundays at 6 p.m. EST. You can also listen in on satellite on Spacenet 3, transponder 9, 6.8 audio. For more information on stations carrying the program, contact flagship station KFNN at (602) 241-1510.

Entire ARRL Bio-Effects Committee Quits

The American Radio Relay League's Bio-Effects Committee has disbanded en masse. The handpicked group of internationally acknowledged experts in the field of potential health risks from exposure to RF radiation formally resigned in writing on June 1st.

In the letter of resignation, signed by all five members, chairman Ivan Shulman, M.D. WC2S wrote: "We will, however, not allow our names to be subject to the political machinations and narrow views of individuals who seek to use us for their own aims as 'window dressing' . . ."

The ARRL published an article in the April 1994 issue of *QST* by Wayne Overbeck N6NB which stated, "Fortunately, enough research has now been done that we know most amateur radio activities are quite safe." Meanwhile, the May issue of *73* carried actual Congressional testimony by former ARRL committee member Ross Adey, M.D., K6UI in an article called "The Radar Gun Reality." Dr. Adey stated that federal agencies " . . . should assume direct responsibility for developing and implementing urgently needed safety guidelines for RF/microwave exposures." He added that more research was desperately needed, especially in the athermal effects of radiation.

The ARRL Bio-Effects Committee was appointed in January 1990 by then ARRL President Larry Price W4RA " . . . with the distinctive charge of revitalizing organized amateur radio's concern for the limitation of bio-effects hazards that might arise from the participation of individuals in the hobby of amateur radio." *TNX W5YI Report, Issue #12, June 15, 1994; QST, April, 1994.*

FCC Can't Relax Anymore

The Federal Communications Commission has denied two Petitions for Reconsideration of its decision to relax restrictions on the scope of permissible communications in the Amateur Service. The commission amended its rules to allow licensees to use Amateur

Three National Capitol DX Assn. members collectively worked 665 countries in the NCDXA 12-month DX hunt. Pictured (L to R) are: Dave Hammond WC4B (201), Ken Miller K6IR (227), and ARRL Director John Kanode N4MM (237).

Service frequencies to facilitate events such as races and parades, to support educational activities, to provide personal communications such as making appointments and ordering food, to collect data for the National Weather Service, and to provide assistance voluntarily, even where there are other authorized radio services available.

David B. Popkin and Rolland D. Cummings filed petitions requesting further relaxation of the rules to permit the retransmission of time broadcasts originated by government stations. Popkin also asked the commission to permit the retransmission of other information originated by government stations, and to substitute the phrase "instructional activity" for the phrase "classroom instruction."

The FCC denied reconsideration, saying the petitioners had merely reiterated views already expressed in comments to the Notice of Proposed Rulemaking. *TNX Westlink Report, No. 673, June 6, 1994*

Majority Call Ham Radio Valuable

H.J. Res. 199, the Joint Resolution recognizing the Amateur Radio Service, now has a majority of the U.S. House of Representatives as cosponsors. On April 11th, four additions to the list of cosponsors brought the list total to 220 (of which three are non-voting delegates). The four are Rep. James Talent (R-MO), Del. Eleanor Holmes Norton (D-DC), Rep. Thomas Ridge (R-PA), and Rep. Don Young (R-AK).

The resolution seeks formal recognition of the value of amateur radio to the country. It would support amateur radio as "national policy." It would also encourage rules and regulations to facilitate amateur radio as a public benefit by encouraging new technologies. There are now 218 voting sponsors, including Resolution sponsor Jim Cooper (D-TN). There are currently 434 Representatives in the House. *TNX Westlink Report, No. 673, June 6, 1994.*

10 WPM Generals?

"Slow-code" is the name given to an Amateur Radio Industry Association proposal to lower the General Class code speed requirement to 10 words per minute. So far, it has gained far more support than criticism in ham radio circles. Most of the packet radio postings on slow-code praise the industry group's leadership. Some even say 10 WPM doesn't go far enough, with 5 WPM being suggested instead.

Slow-code is also getting support from users of various public bulletin boards. An unofficial poll being conducted by Newsline is so far five-to-one in favor of the Amateur Radio Industry Association's slow-code proposal.

The association has yet to announce a firm date for filing its slow-code rule making request before the FCC. *TNX Westlink Report, No. 673, June 6, 1994.*

Let Market Forces Decide

FCC Chairman Reed Hundt said his agency's goal in devising rules for auctioning the airwaves for new communications devices later this year is to let market forces decide who will conduct business profitably within that spectrum. Hundt said the commission will not limit the number of licenses that result from the bidding for that spectrum, nor will it prevent a licensee from piecing together spectrum to reach a big geographic area.

Speaking before the Harvard Business School Club of Greater New York, Hundt stressed the need for greater competition in telecommunications, at times defending the FCC's recent regulatory actions as laying groundwork for greater competition.

The FCC plans to auction spectrum for a new breed of wireless communications. This summer it will auction spectrum for narrowband wireless communications such as paging. Later this year it plans to auction spectrum for transmitting broadband wireless signals—from phone calls to video images. *TNX Westlink Report, No. 673, June 6, 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on CompuServe ppn 70310,775@compuserve.com; or at the *73* BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one-stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

Stand-Alone DDS

The Kendraboard provides PC-free frequency control.

by Bruce Hodgkinson VA3BH (ex-VE3JIL)

After I finished the Julieboard DDS synthesizer design (see "Julieboard: An easy-to-build DDS synthesizer for the PC printer port." in the August 1993 issue of *73 Amateur Radio Today*) and built some prototypes, I spent some time using the board and quickly concluded that, even though it worked well, the requirement for a PC was sometimes a problem. This opinion was confirmed overwhelmingly in the phone calls and letters I got from readers after the article came out—it became obvious that the next step would be a stand-alone controller. Here, I want to not only describe my design (the Kendraboard), but also give some hints and suggestions to help readers develop their own designs.

Why a Dedicated Controller?

When paired with a dedicated controller, a DDS synthesizer can be used in a stand-alone configuration:

- No bulky PC needed.
- No time needed for boot-up.
- Extremely fast operation.
- Low power/small package (ideal for QRP).
- Much lower radiated digital noise.

As a self-contained digital tuning unit for home-brew gear, it is an ideal way to prototype design ideas and develop software for a future digital transceiver. Also, there are many other excellent CPU-controlled parts, such as D/A and A/D converters, PLLs, and displays which can be used with a controller to form a complete system.

Choosing the Right Microcontroller

There are many different types of computer chips (and systems) available on the market—the first design decision will be to pick one. It is tempting to choose a device because of cost or because there's lots on hand, but there are other considerations which are generally more important:

- Can it easily do the job?
- What development systems are available?

If the candidate will not work, or is only marginally capable of doing the job, it is not suitable even if free. Future needs should be considered to avoid hardware/software obsolescense and to allow for new features. For example, I chose the Motorola MC68HC705C8 largely because of its serial and SPI ports. Even though the present software does not use these functions, future versions will, and I will be able to use the existing hardware as is. Next, the availability of development systems (especially affordable ones!) should be considered—if you can't get the code into it, that otherwise-perfect processor is worthless.

Development Systems

Unlike a PC, a single-chip microcontroller usually does not have an operating system resident on it. This can make code development a bit tricky without the proper tools. The development process requires the designer to:

- Write the code.
- Assemble or compile into machine code.
- Get the machine code into the device.
- Test the device in its intended place.
- Find any bugs.
- Rewrite the code as required.

Photo A. Kendra and her board. (Photo by Sandy VE3AAC.)

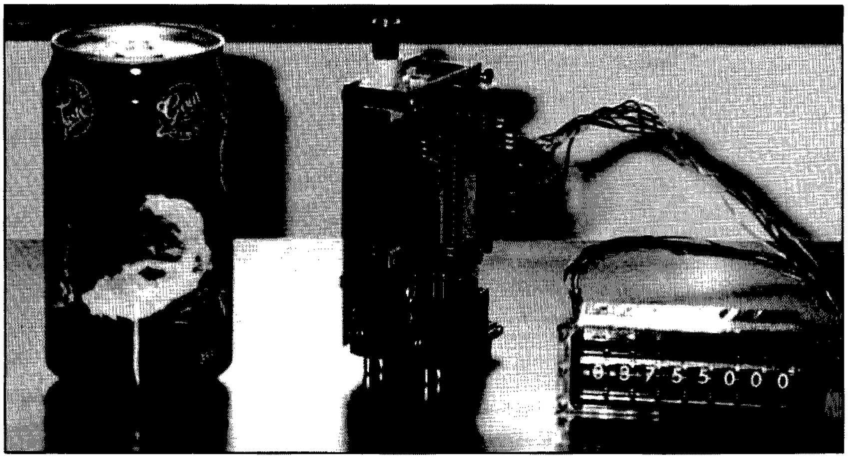


Photo B. Two boards make stand-alone DDS. (Photo by Sandy VE3AAC.)

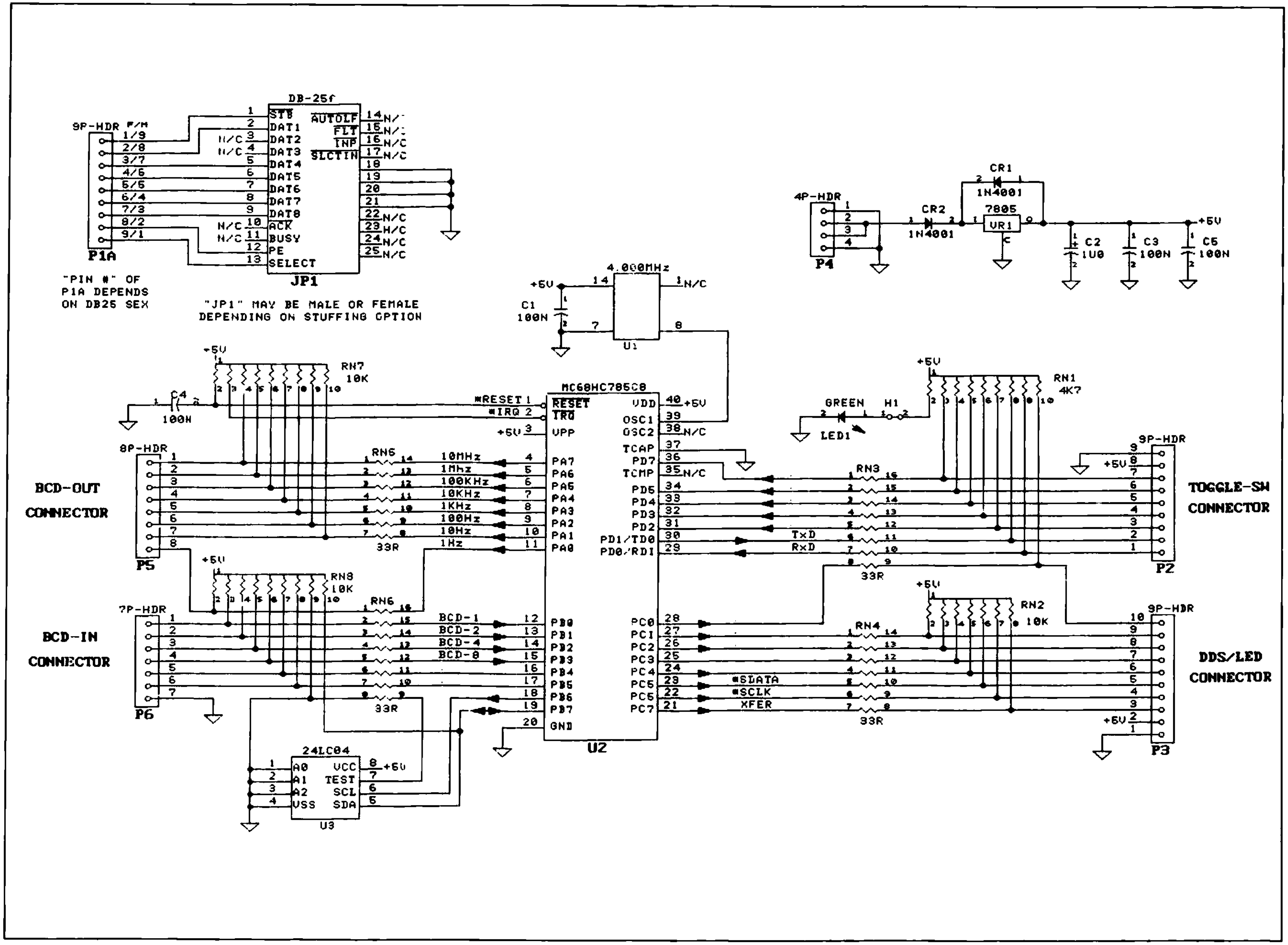


Figure 1. Schematic.

The best approach is to get an evaluator board and development software which allows the user to write the program in whatever language is convenient, translate it into machine code, and transfer it into an emulator system which mimics the intended device. With this scheme, the developer can write a bit of code, try it out, and confirm that the routine works as intended by looking at internal memory and registers. It is possible to write the code blind, manually transfer it into an EPROM, then into the device via bootstrap mode, but that makes debugging very difficult—much like building a mechanical machine, welding the covers on, then trying to figure out its behavior by whether the wheels turn!

Fortunately, vendors such as Motorola make available freeware assemblers which take the English-language source code, convert it into the machine-readable object code, and put it into file transfer formats suitable for downloading. (Motorola uses the "S19" format.)

Also, Motorola markets low-cost evaluation and programmer boards—these can be used to emulate and program single-chip micros. With the "M68HC05PGMR" board, for example, small programs can be downloaded into the 'C8 device's internal RAM and executed without having to program the on-chip EPROM. Once the routine is verified, it may be programmed (by the same board) into the MCU and used as a building block by other routines. With careful strategy, quite a long program can be developed chunk-by-chunk without needing fancy tools. My programmer board (bundled with some pretty good software) cost me about $68.05 (US) three years ago and I believe it is still available.

Ask around at the computer club or local college and look in the ads in magazines such as *Midnight Engineering* and *Circuit Cellar* for possible development board candidates. If the price for a good system is too steep (they can run a couple of hundred dollars) for one budget, consider finding a buddy (or buddies) to split the cost with. Not only do you get access to a system at less cost, but if you share your experiences, it makes the learning curve a lot easier!

Hardware Description

The circuitry for the Kendraboard fits on a small single-layer 2.5" x 4.5" printed circuit board (same size and shape as the Julieboard). It is a very low-tech board which is well within the fabrication abilities of the average ham. I made mine using an "ironed-on" reversed-image photocopy as an etch resist! My design objectives were simple: lowest possible density for ease of home fabrication, mechanically compatible with the Julieboard, and capable of future expansion with the existing design.

"If the price for a good system is too steep (they can run a couple of hundred dollars) for one budget, consider finding a buddy (or buddies) to split the cost with."

Board logic is very simple; it consists of a Motorola MC68HC705C8 single-chip microcomputer (MCU) and its support circuitry. The micro itself provides all operational functions, except for master clock generation. (It was easier to fit in a small clock oscillator module than the discrete oscillator components and I didn't want to spend a lot of time making them fit). The 'C8 was chosen because an MC68HC05EVM evaluation board was on hand and the chip features:

- 7.7K bytes EPROM (or OTP).
- 176 bytes RAM.
- 24 bidirectional TTL I/O lines.
- 7 input/special purpose TTL lines.
- Serial (ASCII) communications interface.
- Serial (binary) peripheral interface.
- Easy-to-use 40-pin DIP package.

This device is considerably more powerful than what this application actually requires, but I wanted to provide for future growth.

The series resistors are used as a buffer between the "outside world" and the MCU for ESD and as an aid to EMI suppression. The pullup resistors are needed to define input levels for idle I/O pins (this is important for CMOS devices such as the 'C8).

All I/O connectors, except for one, a male or female DB25, are 0.100 friction-lock SIPs and are intended to be used with matching housings loaded with crimp terminals. The DB25 can be wire-wrapped for plug-in compatibility with the Julieboard, either via a DB25/ribbon cable "backplane" as a female, or directly to the Julieboard DB25 as a male. The serial EEPROM is a future item for when I want to do nonvolatile channel storage and clock frequency error calibration. Presently, the software does not support the EEPROM, so it may be left out, if desired.

Like the Julieboard, supply voltage input can range from about +7VDC to +12VDC, and is protected against reverse-polarity damage.

Software Description

In order to simplify the software as much as possible for the initial version, BCD thumbwheel switches were used for frequency control and display. (A keypad and LCD display could have been implemented, but the software required would have been much more complicated.) To drive the DDS, the software must perform these functions:

- Set up the microcomputer internal registers.
- Read the thumbwheel switches digit by digit.
- Do a BCD-to-binary conversion.
- Send the binary data to the DDS chip.

Set Up the Micro: The I/O lines used for the BCD digit "commons" and DDS control are set up as outputs, while the BCD read-back lines are set up as inputs. Unused I/O lines are configured as inputs and are pulled HIGH by the board pull-up resistors. Other processor functions (SPI, SCI, timer, etc.) are not presently used, but will be used in the future. At that time, code will have to be added to initialize these items. Once the micro has been initialized, control passes to the BCD thumbwheel switch read-routine.

Reading the BCD Thumbwheel Switches: Each BCD switch consists of a COM terminal and four output bits which are connected/disconnected to the COM terminal, depending on code. The required switch function is:

Code:	8	4	2	1
0	off	off	off	off
1	off	off	off	on
2	off	off	on	off
3	off	off	on	on
4	off	on	off	off
5	off	on	off	on
6	off	on	on	off
7	off	on	on	on
8	on	off	off	off
9	on	off	off	on

The output bits are paralleled via diodes: The cathodes go to the individual 8-4-2-1

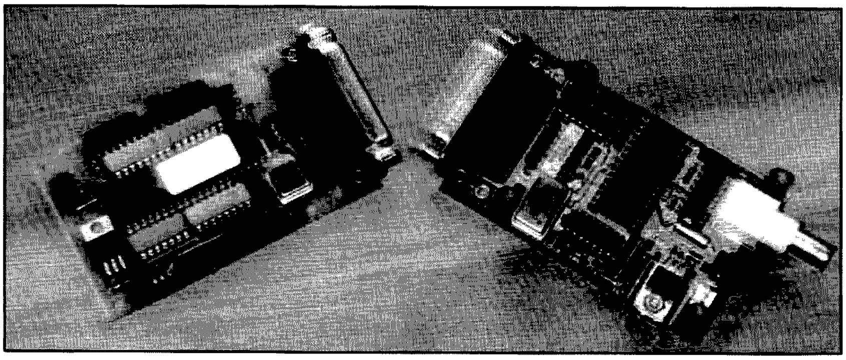


Photo C. Kendraboard and Julieboard. (Photo by Sandy VE3AAC.)

switch outputs and the anodes go to the common 8-4-2-1 bus (which goes to the MCU for readback.) This configuration has the ON bits for a given digit pulling LOW during readback, with the OFF digits staying HIGH. (Yes, this means 32 diodes for a full eight-digit interface! Look for switches with provision for on-board diode mounting—they do exist.) The COM line for each digit is connected to a unique microcontroller output line which is driven LOW by the processor while that digit is being read. After a digit is read, its value is placed in a memory location reserved for that value, to be used by the BCD-to-binary conversion routine. Once all eight lines have been read (and the eight memory locations filled by switch values), the routine passes control to the BCD-to-binary conversion routine.

BCD-to-Binary Conversion: At first glance, this appears to be a complicated function with lots of floating point math, but it's actually a very simple routine. What I did was to work out a binary weighting constant for each BCD digit, then accumulate (add to a running total) it a number of times equal to the value of that digit. For example, suppose that I have dialed up "03755200," which corresponds to 3.7552 MHz:

First, I clear a binary register then, one-by-one, I examine each BCD digit and accumulate its binary constant that number of times:

0—add the 10 MHz constant 0 times
3—add the 1 MHz constant 3 times
7—add the 100 kHz constant 7 times
5—add the 10 kHz constant 5 times
5—add the 1 kHz constant 5 times
2—add the 100 Hz constant 2 times
0—add the 10 Hz constant 0 times
0—add the 1 Hz constant 0 times

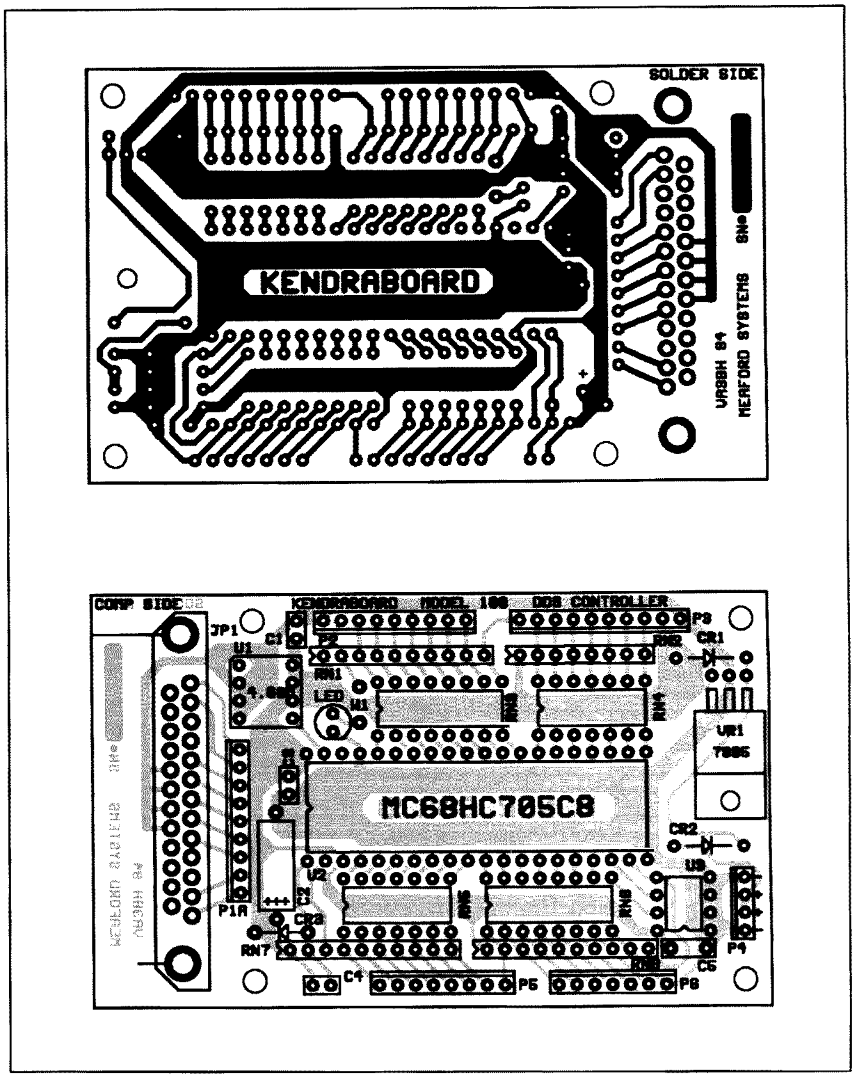


Figure 2. PCB layout.

This accomplishes the conversion simply by doing a trivial binary calculation many times. In the worst possible case, 99.999999 MHz, only 72 accumulates of weighting constants need be done, so this routine is fast.

Since the DDS binary register size is 32 bits, this would suggest that weighting constants should be 32 bits each. Initially, I used 32-bit values for the weighting constants, but found that 70-odd repeated calculations could cause what I considered to be an excessive amount of round-off error. I then redefined each constant as being 40 bits—32 bits whole and 8 bits fractional—accumulated them to a 40-bit register, and took the upper (non-fractional) 32 bits as the binary result, discarding the 8 bits fractional remainder.

I am now happy with the results of the improved algorithm. Another nice thing about this scheme is that it can be used to do any other channel-to-DDS-binary conversion just by using a different initial value (not necessarily zero) and re-doing the weighting constants for each programmable digit. For this design, using a Julieboard with 40 MHz clock, the weighting constants are:

10 MHz: 4000000000
1 MHz: 0666666667
100 kHz: 00A3D70A3E
10 kHz: 0010624DD3
1 kHz: 0001A36E2E
100 Hz: 000029F16B
10 Hz: 00000431BF
1 Hz: 0000006B61

Send Binary to the DDS Chip: This is a simple routine: Shift 32 data bits into the DDS, then pulse the *XFER line to capture the new frequency value. Once this has been done, the micro goes back to "Reading the BCD Thumbwheel Switches" and the cycle endlessly repeats. Cycle time is quite fast: The loop time is about 6mS—instant response as far as human perception is concerned.

The machine language listing is shown in Figure 4. This is a modified Motorola ".S19" file with spaces added to separate address, code, and formatting fields. The first column, "Sxxx . . . " is a formatting field used to show the beginning of each file line. The next field represents the start address for each block of binary data. The third field (in bold) shows the actual code/data as burned into the EPROM.

The first block is data placed in EPROM addresses $1000-1027, which represents the binary weighting constants described above (in scrambled form). The second block is machine code placed in EPROM addresses $0100-0216. This code can be translated by hand (albeit tediously) back into the original assembler format to show what the program does, in a human-readable form. The last 2-byte "block" of data which is placed in the RESET vector at $1FFE-1FFF to tell the computer the starting address upon power-up.

Continued on page 18

Stand-Alone DDS

Continued from page 16

Finally, the final column (and all of the last line) represents checksums, one per line.

This format is a very compact way to list a computer program (the source code, with comments, is 342 lines long!) and is used by Motorola as a protocol for data transfer into a programmer. To restore the magazine copy back to the .S19 format, type the text into a word processor (omitting all spaces and bold-ing of the binary code). The file, when correctly saved as an ASCII file, is 918 bytes long and should load into an EPROM programmer or evaluator board.

Developing the Software (Hints)

The software is not difficult to write, especially if a few simple rules are followed:

- Use a development system, pick MCU accordingly.
- Use modular program structure.
- Use RAM for inter-routine interface.
- Use flow-charts/"pseudo-code."
- Test algorithms in higher-level language.
- Use in-line code to avoid branches (initially).
- Change or add just one thing at a time.

A development system is so useful that the choice of micro often depends upon which systems are available and for what price. Nothing beats hands-on/real-time access to your code for bug-killing. Keeping the code in RAM allows for easy patches and experimental code without having to re-compile or assemble, then program, over and over and over again. I chose the 'C8 because I have the evaluation board (and paid less than $70 for it!). Also, some means of EPROM "blasting" of the single-chip is needed—also done by the evaluator board.

Partitioning the software into smaller routines is generally done for all but the most trivial programs. By reducing a complicated program into a group of simple programs, the job will go much quicker—it is far easier to debug several simple routines one at a time than it is to sort out one large complicated one. The ideal approach is to write the routines one by one and graft them into the existing work as they are debugged. This was done here by defining several tasks which were done sequentially at single points in time. For example, once the micro is initialized, it never has to be re-initialized. Likewise, once the BCD switches are read, they are not re-read until the BCD values are converted to binary and sent to the DDS chip. For my system, partitioning was obvious: initialize, read switches, binary-convert, and send to DDS.

Use RAM locations for inter-routine interface. This means defining a block of RAM for the input data and (if possible) another block of RAM for output data. Try to keep the two blocks separate—this makes debug and patching much easier. Routines can be debugged independently by placing values in input RAM, running the routine, and looking at the output RAM to see if the expected results are there. If the program does not destroy its input variables upon execution, it can be run and re-run until debugging is done; otherwise, the input data has to be reloaded prior to each run. Naturally, if RAM space in the micro is limited, this rule may not always be practical, but it is a generally good strategy and makes the code more modular.

It is tempting to just dive in and start writing code, but programmers generally use flow charts or "pseudocode" to map out logic flow and settle in their minds how the finished routine will work. There is probably no better way to catch errors than to document how something works. Often something which seemed right in one's mind will look strange on the printed page and, sure enough, a closer look will spot the bug. Also, once a program has been "put to bed," it tends to be forgotten, so if documentation is not done up-front, the routine might have to be "reverse-engineered" later if it ever has to be modified or if a future bug pops up.

Flow charts use boxes, diamonds, and ellipses to show program flow, while pseudocode is an "English-language" task-by-task description of what has to be done. I favor pseudocode—it is compact, takes no extra time for box-and-line drawing, and I can do it on my word processor.

Here is some of my pseudocode (done for the BCD-to-binary routine):

```
START:
8x digit 40-bit constants in ROM
8x BCD digits in RAM:A = 10 MHz value
                     B = 1MHz value
                     C = 100KHz value
                     D = 10KHz value
                     E = 1KHz value
                     F = 100Hz value
                     G = 10Hz value
                     H = 1Hz value
clear/init forty-bit register FREG
add (10MHz) constant 'A' # of times to FREG
add (1MHz) constant 'B' # of times to FREG
add (100KHz) constant 'C' # of times to FREG
add (10KHz) constant 'D' # of times to FREG
add (1KHz) constant 'E' # of times to FREG
add (100Hz) constant 'F' # of times to FREG
add (10Hz) constant 'G' # of times to FREG
add (1Hz) constant 'H' # of times to FREG
32 MSB's of FREG equal DDS binary code
EXIT:
```

Note that there are no branches and loops in this pseudocode—it is written "in-line." Branching errors are very common

Parts List

Qty.	Loc.	Description	Digi-Key #
1	U1	40.00 MHz osc. module	CTX155
1	U2	Motorola MC68HC705C8S microcomputer	(Note 1)
1	U3	EEPROM (not presently used)	24LC04/P-ND
1	U2	40p machined (gold) IC socket	ED3640
2	U1,U3	8p machined (gold) IC socket	ED3308
1	VR1	7805 regulator (TO-220)	AN7805
1	LED1	Green-light-emitting diode	P309
2	CR1,CR2	1N4001 diode	1N4001
2	RN3,RN6	33R resistor network (16dip8)	761-3-R33
2	RN4,RN5	33R resistor network (14dip7)	760-3-R33
1	RN1	4K7 resistor network (10sip9)	Q9472
1	RN2	10k resistor network (8sip7)	Q7103
2	RN7,RN8	10k resistor network (10sip9)	Q9103
3	C1,C3-4	100N ceramic cap (0.1" L.S.)	P4917
1	C2	100N ceramic cap (0.2" L.S.)	P4887
1	C5	22U aluminum electrolytic cap	P5411
1	"JP1"	Male or female right-angle DB-25	(Note 2)
1	P4	4x1 male header	WM4202
1	P6	7x1 male header	WM4205
1	P5	8x1 male header	WM4206
2	"P1A,"P2	9x1 male header	WM4207
1	P3	10x1 male header	WM4208
1	@P4	4x1 female housing	WM2002
1	@P6	7x1 female housing	WM2005
1	@P5	8x1 female housing	WM2006
2	@P1A,@P2	9x1 female housing	WM2007
1	@P3	10x1 female housing	WM2008
1		Blank printed circuit board	(Note 3)

Note 1. Blank C8s available from FUTURE Electronics; programmed C8s available from author (Box 232, Pakenham, Ontario, Canada K0A 2X0; 613-624-5247).

Note 2. You can use either male or female DB25 at JP1, depending on the desired option.

Note 3. Available from the author (see Note 1).

in raw code and the loops and branches can make following the program flow difficult. The use of in-line code is not "efficient" as far as memory space is concerned, but it is good for debug efficiency and it is better to have good fat code than compact buggy code. Once the code is debugged, *then* it can be "optimized." Also, in-line code generally runs faster and is much easier to follow if it has to be modified at a later time by a third party.

The last item is a lesson that I seem to have to learn every time I do a program. *Change only one thing at a time!* It is tempting to change several things at once before doing another download or PROM-blast, but if you do it this way it can be hard to see just which change caused which bug.

Using the Controller Board

Connections are made to the Kendraboard as follows:

Pin	MPU Port	Signal
P6-1	PA7	x10MHz COM
P6-2	PA6	x1MHz COM
P6-3	PA5	x100KHz COM
P6-4	PA4	x10KHz COM
P6-5	PA3	x1KHz COM
P6-6	PA2	x100Hz COM
P6-7	PA1	x10Hz COM
P6-8	PA0	x1Hz COM
P5-1	PB0	BCD "1" line
P5-2	PB1	BCD "2" line
P5-3	PB2	BCD "4" line
P5-4	PB3	BCD "8" line
P3-1	GND	Julieboard ground
P3-3	PC7	Julieboard ★XFER (P1-7)
P3-4	PC6	Julieboard SCLK (P1-6)
P3-5	PC5	Julieboard SDATA (P1-2)

The connections on P3 can be made directly to the Julieboard via a cable or via wire-wrapped jumpers bridging P3 to the DB25 connector (PI). Note that the physical wiring differs for male vs. female DB25—examine the chosen connector carefully and locate the right pins. (The ground connection need not be made if a DB25 of either sex is used.)

The single in-line connectors are cnd-stackable, so some connectors could be partitioned into two smaller connectors. For example, "P6" could be implemented with a 4-pin connector to bring in the 4-bits BCD from the switch matrix and a 3-pin connector to bring out the spare two Port B bits and ground. This allows a more modular system where the thumbwheel switch cabling is completely separate from the cabling to those two spare bits. Likewise, connectors P2 and P3 may be partitioned into subsets.

Note that Julieboard signals ENPHACC, SHIFTEN, and BANKSEL are not presently used, but could be in future versions. One advantage of using the DB25 is that an opposite-sex multiple DB25 "backplane" arrangement can be used to allow addition of future boards to the set. (For example, a

Machine Code Listing (Modified .S19 File)

```
S113    1000    4006000000000000000066A31001000000    7C
S113    1010    0066D762A329040000680A4D6EF1316B      A3
S10B    1020    00673ED32E6BBF61                      93
S113    0100    A6FFB704A6FFB700A600B705A6FFB706      6B
S113    0110    A67FB702A600B7B0B7B1B7B2B7B3B7B4      4A
S113    0120    B7B5B7B6B7B7AE00A67FCD0209A6BFCD      A7
S113    0130    0209A6DFCD0209A6EFCD0209A6F7CD02      7A
S113    0140    09A6FBCD0209A6FDCD0209A6FECD0209      32
S113    0150    3FA83FA93FAA3FAB3FACAE00CD01D1AE      13
S113    0160    01CD01D1AE02CD01D1AE03CD01D1AE04      9A
S113    0170    CD01D1AE05CD01D1AE06CD01D1AE07CD      B5
S113    0180    01D1B6A8CD01DDB6A9CD01DDB6AACD01      58
S113    0190    DDB6ABCD01DD1A02CD01FF1E02CD01FF      9C
S113    01A0    1F02CD01FFCC012698B79FB6ACD91020      11
S113    01B0    B7ACB6ABD91018B7ABB6AAD91010B7AA      5A
S113    01C0    B6A9D91008B7A9B6A8D91000B7A8B69F      80
S113    01D0    81E6B02707CD01A84ACC01D381BF9EAE      EA
S113    01E0    08CD01EA5A26FABE9E814824051B02CC      9A
S113    01F0    01F41A029D9D9D1D029D9D9D1C0281B7      C7
S113    0200    9FA6104A26FDB69F81B700CD01FFB601      17
S10A    0210    43A40FE7B05C81                        79
S105    1FFE    0100                                  DC
S9030000FC
```

T-R adapter/amp board and updated software will allow me to use this combo in VFO service for my Atlas 210 transceiver.)

My favorite use for the stand-alone combo is as the LO for a tunable mixer. I have a Mini-Circuits SRA-1 mixer in a BNC-equipped box: The RF port goes to the antenna, the LO port goes to the Julieboard, and the IF port goes to a surplus crystal-controlled SSB/AM receiver tuned to 6.300 MHz. I program the Julieboard to produce an output 6.300 MHz above/below the desired frequency, set the proper sideband, and . . . voilà! Someday, I will mod the software so I won't have to do the frequency offset in my head.

Of course, this controller is suitable for controlling things other than just Julieboards. For example, one of the newer high resolution D/A converters could be driven to make a digital power supply or voltage source. How about -16.384V to +16.383V adjustable in 1 mV steps via thumbwheel? Or one of the new PLL chips and thumbwheels for a synthesized 6m or 2m rig?

There is no reason why the processor has to be a '6805 (or even a Motorola device). For example, PIC chips are available via DigiKey, and one quite intriguing product is a "BASIC stamp" which runs BASIC programs kept in an on-board EEPROM and is about the size of a large postage stamp.

What's Next?

I plan to evolve my design as I go, and add (in rough order):

- •External BCD display via '595 shift registers.
- •Option for up/down non-mechanical tuning.
- •SCI support (remote operation via serial port).
- •EEPROM support.
- •Offsets for use as transceiver VFO.

Conclusions

I have had the stand-alone controller running the Julieboard DDS synthesizer in my shack for several weeks and am very happy with it. I can't wait to incorporate it in my portable QRP transceiver project. Right now, I have the best of both worlds—if I need special programming functions, the Julieboard can be unhooked and reconnected to the PC; otherwise, it is left attached to the Kendraboard for general purpose operation. Not having to wait for boot-up is great and there is a noticeably lower RF noise level vs. the PC.

"Not having to wait for boot-up is great and there is a noticeably lower RF noise level vs. the PC."

Personal Note

Why "Kendraboard"? Readers familiar with the "Julieboard" article will recall that Julie had two (now three!) sisters and that they expected equal treatment. Kendra thought that naming the controller after her was a great idea. Now Karen wants to know when I'm going to do *her* board . . . 73

Number 5 on your Feedback card

by Steve Katz WB2WIK/6

Azden Corporation
147 New Hyde Park Road
Franklin Square NY 11010
Telephone: (516) 328-7501
Fax (516) 328-7506
Orders (800) 643-7655
Price Class: $389

The Azden PCS-7500H 6 Meter FM Transceiver

50 watts on 6 in an attractive, low-cost mobile.

Azden Corporation is the only manufacturer of monoband mobile FM transceivers for all the popular bands from 28 through 440 MHz and really has a corner on the market for 6 and 10 meter FM rigs. When given the opportunity to review the new PCS-7500H 6 meter FM rig, I was happy to jump right on it, since the 50 MHz band is full of FM simplex and repeater activity here in Southern California.

Six meters is a unique band that combines the propagation advantages of both VHF and HF. For line-of-sight (direct wave) work, 6 is not much different from 2 meters or 135 cm (222 MHz), although the longer wavelength produces less rapid signal strength flutter. Because a quarter-wavelength at 6 meters is about 4'9" long, peaks and nulls in signals are produced by considerably more movement than, say, at 2 meters, where a quarter-wave is only about 19". Tropospherically-enhanced propagation, especially "tropo ducting," occurs less on 6 than on 2 or the higher frequency bands, making those occasional DX contacts a bit more rare; however, the 50 MHz band does afford its users much more frequent sporadic-E ("E-skip") propagation, especially from May through July, and again in December, and 1,200-mile QSOs on 6 meters are not rare. Plus, 6 meters enjoys occasional F-layer propagation, producing contacts to several thousand miles with relatively low power during solar-cycle peaks. If you haven't tried 6 yet, it is surely an interesting band that has its share of die-hard users.

Overview

The first thing anyone notices about the PCS-7500H (or any of the new Azden PCS-7000 series) is how incredibly beautiful it is to look at. It is a fine-looking radio, with every single panel button illuminated with a dark orange glow for easy viewing. The LCD display screen is similarly backlighted and has a warm, inviting glow. Even the push-buttons on the DTMF ("touch-tone") microphone are all illuminated; a nice touch. The rig comes equipped with a convenient and sturdy mounting bracket, a PTT/DTMF microphone, a long DC power cable with the positive side fused, a connector disconnect point about eight inches from the rear of the radio, and all mounting hardware. It also comes with a CTCSS ("PL") encoder built in. The PCS-7500H is rated to produce 50 watts RF output power (with a 10 watt "low power" mode front-panel selectable), programmable frequency steps, and other features normally found on modern FM transceivers.

The PCS-7500H has good and bad points, and I'll try to discuss both fairly. I like thoughtful touches, with which the Azden is loaded. For example, they used a flat-blade automotive-style fuse in the DC power cable. Small point, but these have real advantages over the old-fashioned 3AG, AGC, MDL (etc.) glass cartridge fuses used in most other equipment: They can really handle a lot of current without thermal meltdown, are readily available at gas stations, and are very inexpensive. I also like the connectorized power cable, which uses an automotive-style molded connector set that has also proven its reliability in years of service. Its coaxial antenna cable receptacle, a standard "UHF" SO-239, is firmly mounted to the rear panel of the radio, not hanging on a short coax extension cable as in many modern mobile rigs. Its hand-held PTT microphone has a solid feel and produces excellent transmit audio. (More on this later.) Its receiver audio is full, loud and undistorted, and sounds better than many mobile rigs. And the rig is beautiful, especially at night when one can enjoy all the warmly lit controls. The Azden can accommodate any frequency "split" between transmit and receive, since each channel can be separately programmed (into memory) with TX/RX frequencies, and its 20 memories are adequate for 6 meters. As with all modern FM rigs, each memory will store frequency "split" and PL tone (if required).

I also like the built-in heat-sink fan in the PCS-7500H. It activates after a few minutes of continuous transmission at normal room temperature and helps maintain a "cool-to-the-touch" heat sink, undoubtedly prolonging the operating life of the final amplifier stage.

On the other hand, the Azden is full of quirks, some of which I found a bit annoying. First, the PCS-7000 series all seem to share one instruction manual, written around the PCS-7000(H) 2 meter rig. The PCS-7500H manual contains an "addendum" sheet (one page) which modifies the PCS-7000 manual to suit the 6 meter rig, but this means referring back and forth between two sets of information. And the original PCS-7000 manual contains mistakes and typographical errors. Most aren't meaningful, but I started to proofread the manual in search of errors and stopped when I found a dozen by the fourth page. This reminded me of how badly written the older Japanese equipment manuals used to be, before the manufacturers employed English-speaking technical writers to make them better.

Next, there is no easy way to use the rig with tone-activated (CTCSS) repeaters when in the "VFO" or "Direct" mode. PL-tones are easily programmed into memory, and once this is performed, tone-activated repeaters are easy to use; but if you're "scanning around" looking for activity in an unknown region and stumble across a tone-activated repeater not already in memory, there's no easy

way to access it without programming the required frequency, offset and tone data into memory first. Azden did provide me with an updated sheet entitled, "Error in Azden PCS-7000H Instruction Manual" which does describe how to use a PL tone in the "Direct" mode, but the procedure is so complicated it couldn't possibly be performed while driving.

The rig's 20 memory channels are stored in two banks of 10, called A0-9 and B0-9. No big deal, although simply calling them 0-19 or 1-20 might have been nicer. But the rig always "powers up" on memory A0, regardless of where you used it last. This is frustrating, especially since all my other modern FM transceivers "remember" where they were last used and "power up" on the last-used channel.

Also, there's no VFO/memory knob of any kind on the Azden, nor may frequencies or memory channel numbers be entered directly with keypad strokes. The only way to go from, say, memory A3 to memory B5, is by using the "up" or "down" buttons (either on the front panel or on the PTT microphone) to go through all the memories in between. And if you depress the "up" or "down" button more than momentarily, the rig begins scanning through the memory channels very quickly, much too fast to stop on the channel of your choice. With the technology and chip sets available today, there's no reason for any channelized radio to not have "direct frequency entry" with keypad strokes. (That is, if you wish to "dial up" 52.525 MHz, you'd just depress 2-5-2-5 on the keypad, and the rig would go there instantly.) This used to be tricky in the old days, but can now be done with one $2 chip. In Azden's defense, however, I must admit that many modern FM mobile rigs still don't contain this feature. Darned if I know why not.

Another minor annoyance is that a user of the PCS-7500H must refer to a "Tone Code Table" when programming PL tone frequencies. That is, the CTCSS frequencies, of which there are 38 in common use, are not actually displayed by the Azden during the PL selection process. Instead, tones are selected and displayed by two-digit codes which might only be memorized by The Amazing Kreskin. Since I'm not so amazing, I had to constantly refer to a chart on page 14 of the instruction manual to determine which two-digit code corresponded to each PL tone frequency. For example, Code "19" corresponds to a CTCSS frequency of 127.3 Hz. Sid Wolin at Azden in New York did advise that the newer-generation PCS-7000 series (unavailable at this writing) would incorporate a new microprocessor which allowed direct PL frequency address and readout, as on their handie-talkies.

Programming the PCS-7500H takes some getting used to if you are more familiar with one of the other brands of equipment. It's not difficult, but might be too complex for use "on the fly" while driving. Again, to be fair, most of the mobile rigs I've used are too complicated to program without focusing complete attention on the task. But the Azden instruction manual makes the job sound more difficult than it is, with 12 paragraphs assigned to the description. The Azden is unique in that it only stores the memory data when you turn the rig off, and then back on. To quote from the manual, "Note: Be sure to turn off the power when you have completed programming. This procedure is required to get each setting programmed in and then to get out of the programming mode." Weird, but it works.

With all these quirks to write about, you may get the idea that I really don't like the Azden. This isn't true. I do like the rig, but it took more getting used to than it should have. In terms of performance, the Azden is an impressive package.

The Technical Side

One thing I like a lot is that Azden provides "full-sized" schematic diagrams for their rigs. They are clear and easy to read without a magnifying glass, and will be of value to those who like to perform modifications or do their own service work. The schematic for the PCS-7500H reveals the transmitter final power amplifier to be discrete (2SC2097), rather than a molded hybrid "brick" (modular) amplifier as used by most other manufacturers. I like the discrete approach better because it is more user-serviceable for reasonable cost. Should the PA "final" ever go out, it will be much cheaper to replace a $10 transistor than a $90 module. Not that I would expect the final to fail; the people at Azden assured me they've never seen one fail yet.

The PA circuit board also contains a discrete driver stage (2SC1972), the thermal detector which switches on a cooling fan if the heat-sink temperature gets too hot, the VSWR protection detector circuit (which shuts the transmitter down if a gross antenna mismatch occurs), and a bandpass filter circuit which is in line with the antenna to both the receiver and the transmitter. PA stage tuning is accomplished by a three-section low-pass matching network. One drawback to the discrete PA stage is its critical tuning: The PCS-7500H does deliver 50 watts as rated into a perfect 50 ohm resistive load, but power output falls off rapidly when the transmitter is faced with any mismatch at all. The antenna I used for most of my testing, a vertical with a measured VSWR of 1.5:1, only allowed the transmitter to deliver between 28 and 42 watts, depending on the operating frequency and exact nature of the mismatch. Some of the "brick" stages, while costly to replace, are more forgiving of mismatches.

The receiver's front end, a 3SK101 dual-gate MOSFET, is protected against transients by "back-to-back" signal diodes and features bandpass tuning of both its input and output to help reduce interference and intermodulation from adjacent services. The first RF mixer, another 3SK101 with an output of 14 MHz, is followed by a four-pole crystal filter whose output drives the IF SYSTEM integrated circuit, an MC3361D. The receiver's second IF at 455 kHz is filtered by a 15 kHz bandwidth ceramic filter, type KBF455R15A. The receiv-

er isn't razor-sharp, but suffices nicely with the 20 kHz channel spacing commonly used on 6 meters. One might think that a VHF rig with a first IF at 14 MHz could be easily interfered with by strong 20 meter signals, but I didn't find this to be a problem.

The transmitter uses what Azden proudly describes as "true FM" for modulation, and I guess it is, with the microphone amplifier stage directly driving the VCO variable-capacitance tuning diodes. However, I've never been able to tell the difference between "true FM" and "phase modulation," since, mathematically speaking, one is the reciprocal of the other and a phase-modulated signal, when integrated, becomes "FM."

I did have a problem with the unit as received, in that the transmitted modulation was tinny and distorted. Azden was surprised to hear this, and immediately shipped a new microphone, thinking that was likely to be the problem. It was, and the new microphone produced clear, crisp modulation that received compliments on the air. (I must say, Azden's service in this instance was remarkable. They must have shipped the new mike the day I called them on the telephone, because I received it the next day, 3,000 miles away!)

One thing I think is a bit "clunky" about the Azden is that it uses an old-fashioned relay for transmit-receive RF switching. Relays work fine, and Azden claims they've never had one fail, even in prolonged packet radio service, but their switching "turnaround" speed is rather slow compared with solid-state switches, and if the radio is used for packet, the user may have to re-set switching parameters in his TNC program. I was used to using 30 milliseconds (mS) or less in packet switching, but this is too fast for a relay. I'd recommend more like 300 mS for a relay-operated rig. There's not a lot of packet activity on six anyway, but if you really wanted to, you could home-brew a PIN diode modification fairly easily.

A listing of manufacturer's ratings vs. bench measurements made on the PCS-7500H is contained in the sidebar.

Summary

It took me a while to get used to the Azden. It does have quirks, as described earlier, that make it more troublesome to use than I'd like. But for an affordable, single-band 6 meter FM rig, it's almost the only game in town. Same goes for 10 meters, with the PCS-7800H. I understand the Southern California Six Meter Club, which actively promotes the use of this band, has ordered a great number of these radios for their members and they are well accepted. In speaking with local 6 meter repeater owners, I found they were all very aware of the Azden and were either using one personally or had at least had their hands on one. It does disturb me a bit that the transmitter power output falls off so sharply when connected to other than a perfect load, but since the FM subband on 6 meters is a narrow window of our spectrum (3 MHz), I suppose anyone with a lick of sense could tune his antenna to provide a good match if he had to.

The radio as reviewed is good. With the improvements Azden has planned, such as eliminating the two-digit PL tone codes, it will be even better. If they also rewrote the instruction manual, and had one specifically dedicated to the PCS-7500H, it would be better still. *[Factory Note: New and improved manuals are in the works.]* On a scale of one to 10, with a "10" being perfect, I'd rate the PCS-7500H a strong 8: a good rig for the money and, as I said earlier, maybe the only game in town for a modestly-priced 6 meter FM rig. 73

Manufacturer's Specifications vs. Bench Measurements

Variable	Specification	Measured
TX output power	50 watts (high)	47-52W (H)
RX sensitivity	<0.35µV/20 dB NQ	0.30µV/20 dB NQ*
Squelch sensitivity	<0.12µV threshold	0.10µV threshold
Selectivity	15 kHz/-60 dB	15 kHz/-57 dB
RX audio output	2W, 10% THD	2.2W, 10% THD
Power consumption	0.6A RX	0.5A RX
Frequency coverage	50.0-53.995 MHz	50.0-53.995 MHz

*Receiver Sensitivity is usually measured in µV/12 dB SINAD. For comparison purposes, the 0.35 µV/20 dB Noise Quieting would be a lower number if measured using SINAD. At 50 MHz, the difference in this specification for anything less than 1 µV is not critical.

Items unspecified by manufacturer, but noted:

Display window bar graph, number of bars illuminated for 50W TX output: 10. For 10W TX output: 3 to 10, varies with frequency and VSWR.

Display-window bar graph used as RX S-meter, number of bars illuminated vs. received signal level:

1 bar	=	0.9 µV	(-108 dBm)
2 bars	=	1.2 µV	(-106 dBm)
3 bars	=	1.4 µV	(-104 dBm)
4 bars	=	1.8 µV	(-102 dBm)
5 bars	=	2.0 µV	(-101 dBm)
6 bars	=	2.2 µV	(-100 dBm)
7 bars	=	3.0 µV	(-97.5 dBm)
8 bars	=	4.0 µV	(-95 dBm)
9+10 bars	=	5.5 µV	(-92 dBm)

Note: The 9th and 10th "bar" in the bar graph display illuminate together. Signal level change from "S1" (1 bar) to "S9+" (all 10 bars) is 16 dB. This makes the resolution extremely good for weak signal beam peaking, but results in "full-scale" readings for any reasonably strong signal. Not uncommon for FM receivers.

A Novel Dual-Band, Single Feedline, VHF/UHF Antenna

Good performance for less than a sawbuck.

by Don Schendel W7KOH

The introduction of modern 2 meter/440 MHz dual-band transceivers has ushered in a new era in VHF/UHF amateur antennas. For mobile operation, including handhelds, small helical-wound antennas have been designed to cover both bands for dual operation. Other types, used mostly in mobile applications, include quarter-wave vertical elements (2 meter band) that have a phasing coil positioned at a quarter wave (440 MHz) from the feed point for additional operation on the three-quarter meter band. Both types suffer from basic design deficiencies and various trade-offs associated with these forms.

The basic quarter-wave antenna cut to frequency is a well-behaved radiator when properly configured. Its one drawback is that it will only work on one band. This is where various modifications such as phasing coils, stubs, traps and the like come into play, to make it perform at other bands as well. An old matching trick from the 1950s is resurrected here to enable the design of a dual-band antenna that will allow simultaneous operation on both VHF (146 to 148 MHz) and UHF (440 to 450 MHz) with reasonably well-behaved characteristics. 147 MHz and 440 MHz were chosen as the design centers by virtue of their relationship to band activity. Notice a key feature here: The two frequencies relate by a factor of 3!

Photo A shows the actual antenna in a vehicle application. This application is good because of the large metal roof that provides a good ground plane for operation. It also provided a good test bed for performance data such as feed impedance, VSWR, antenna pattern, and the like. Photo B shows a close-up of the constructed antenna. Its basic parts are a length of steel piano wire, a small-diameter brass tube, a PL259 connector and some epoxy adhesive or silicone sealant. The total part cost, not including labor, is less than a $10 bill.

Figure 1 shows the basic relationships involved in the function of the antenna. First, the antenna functions as a standard quarter wave on the 2 meter band, working into a ground plane—in this case, the vehicle's roof. The feed impedance measured at the base of the antenna is approximately 40 ohms at 147 MHz. The vertical length (L) of the antenna is three-quarter wavelengths at 440 MHz. Length S of the sleeve is a quarter wavelength at 440 MHz (6.5") and is electrically/physically connected to the 50 mil piano wire at the bottom of the configuration. Since I scavenged a short piece (7.0") of nickel-plated brass tube from an old antenna rod that happened to have an outside diameter of approximately 0.35", soldering the wire and cut-bent bottom end of the brass tube was no particular problem. It should be noted that the wire must run down the center of the tube and stay parallel to the inside of the tube for its entire length. The top of the brass tube should be sealed with either a

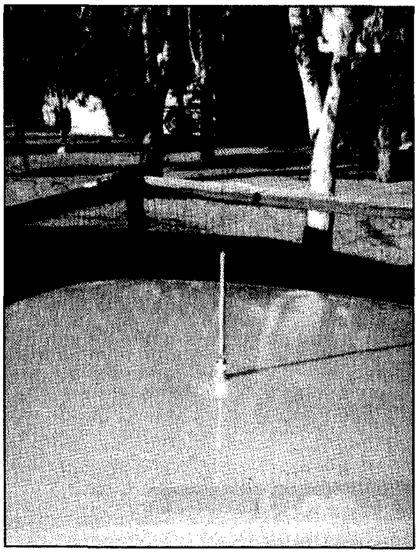


Photo A. The dual-band mobile setup on a truck roof.

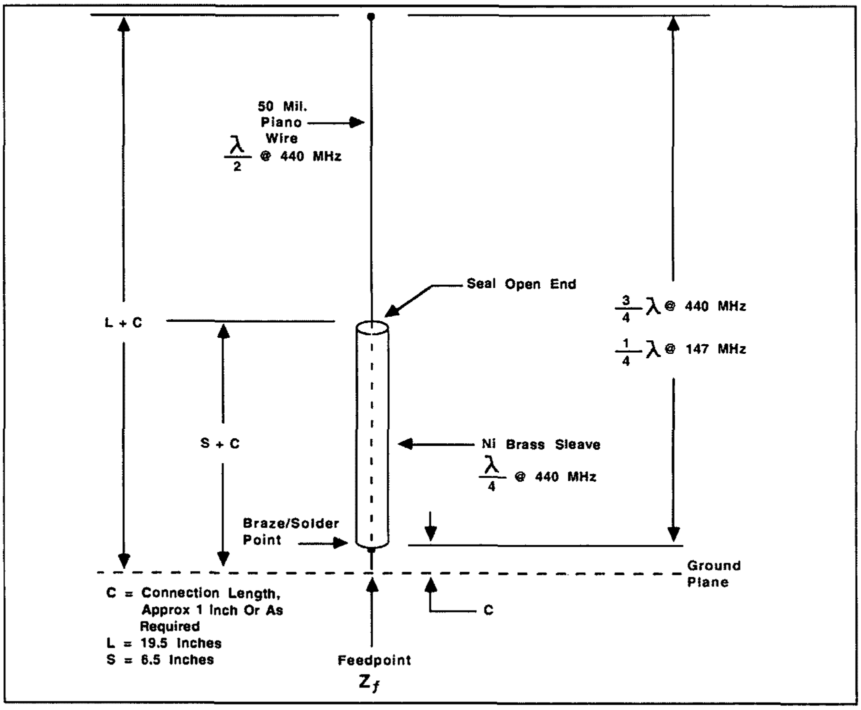


Figure 1. Detailed drawing of the dual-band antenna.

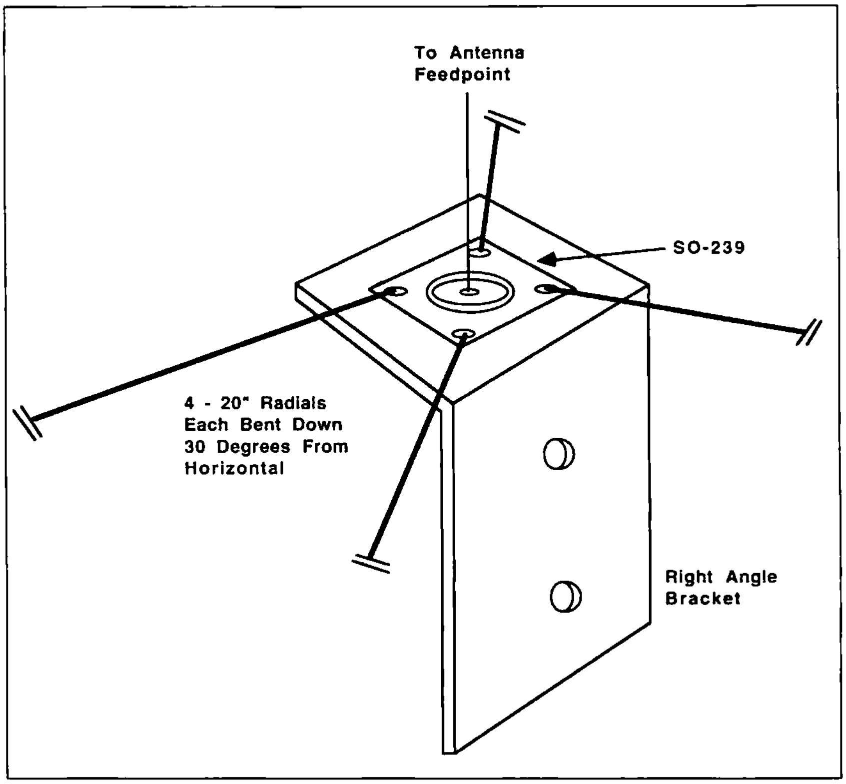


Figure 2. The dual-band antenna set up for a base station.

good grade of epoxy adhesive or silicone sealant. The top end of the brass tube stays "Electrically Open" to the vertical wire!

The brass tube acts as a coaxial sleeve/transformer, sometimes referred to as a "Bazooka," when operated on 440 MHz. The sleeve allows the top portion of the antenna to radiate as a bottom-fed half-wave vertical. The gain is 3 dB greater than a standard 440 MHz quarter-wave antenna. The diameter of the sleeve (tube) is reasonably non-critical and aluminum tubing could be cut and used in place of brass tubing. There is only one problem with aluminum tubing, and that is in the soldering or brazing that is required to join the steel wire and the modified tube end into permanent contact. There are several types of pre-fluxed rods and solders available to do this if you are handy with a shop torch. Otherwise, my recommendation is to scavenge a length of brass or hard-drawn copper tubing for the project, which is much easier to work with. A good rule of thumb is that the ratio of the wire diameter to the outside tubing diameter for reasonably thin-wall tubing is about 10 to 1.

There is nothing difficult or magical about the antenna. It performs well on both bands when properly sized. It is important to cut dimensions accurately. This is true in all antenna configurations, but even more so here because of the transformer properties exhib-

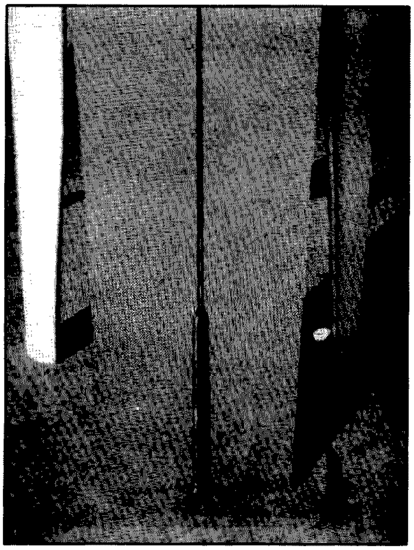


Photo B. A closer look at the dual-band antenna.

Parts List

5	Standard length (30" to 40") of 0.050" +/- 0.005" steel (or stainless steel) tempered wire, one cut to 19.5" (four radials, each cut to 20"). Source: Any craft, hobby or materials supply store.
1	Standard length (10" to 18") of nickel (Ni) plated brass tube of 0.350" +/- 0.005" (up to 0.500", non-critical), cut to 7.0". Source: Any hardware or material supply store.
1	Two-tube set of standard, generic epoxy. Source: Any craft, hobby or hardware store.
1	Solderable PL259 plug. Source: Radio Shack, item 278-205.
1	Solderable SO239 chassis—mount socket. Source: Radio Shack, item 278-201.
1	Right-angle bracket at least 1" wide. Source: Radio Shack, item 15-888 or hand fabricated from aluminum, brass or mild steel flat stock.

Technical Reference: *The Antenna Engineering Handbook*, 2nd edition or later, by Johnson and Jasik, editors; McGraw-Hill, publisher.

ited by the sleeve. Dimensions of antennas become more demanding as the frequency of operation increases. A velocity factor of 97% was used in calculating the quarter wavelengths at each frequency. The operating characteristics on the 2 meter band were plotted, and it was interesting to notice how the resistive part of the feed impedance of the antenna behaves over the operating bandwidth. The VSWR is reasonably well-behaved in the operating bandwidth: It is less than 1.5 to 1. On the 440 MHz end, again the feed impedance seems to be reasonably well-behaved and the VSWR is staying below 1.5 to 1. Overall, dual-band operation is good, with no profound surprises. My test transceivers would not allow both 147 MHz and 440 MHz simultaneous transmission, so I was restricted to single emission mode only for both bands.

The antenna is relatively easy to construct and does not demand complex tools to build with. Except for the soldering or brazing step, everything else is either glued with an adhesive or sealed with an RTV type sealant. The wire can be obtained from your friendly hobby store in 30"-plus lengths. The connector, epoxy and brass tube are available at your local Radio Shack. If you want to use this antenna in a fixed-station mode, don't forget the ground plane! An SO 239 connector on a right-angle bracket makes a good foundation for such an antenna. Four 20" radials (50 mil piano wire) attached to the four corners of the assembly that are bent down 30 degrees with the horizon allow for an almost perfect match of 50 ohms for both bands. Radials must always be longer than radiators by a factor of 2% to 5%. Don't be afraid to experiment and try other construction techniques—this is a good way to optimize an antenna to best fit your personal needs.

Number 7 on your Feedback card

Design and Build a Dummy Antenna

A 40W, 50 ohm RF dummy load with a VSWR of 1.3:1 at 500 MHz.

by Geoff Koehler VE5ZE

A dummy antenna is one of the most basic and essential pieces of test gear in the ham shack. A good dummy antenna must meet two requirements. First, the dummy must be resistive and not reactive at the frequency of the transmitter. The impedance of most military and amateur transmission lines and equipment is 50 ohms, so it is most useful to build a dummy with a 50 ohm impedance. A 50 ohm dummy must present this impedance to the transmitter for maximum transfer of power and proper tuning of the transmitter. Moreover, to be versatile the dummy should not change impedance significantly as a function of frequency. Second, the dummy must be able to safely dissipate the RF energy supplied by the transmitter as heat, and not radiate RF.

The purpose of this article is to describe the design and testing of two simply-built dummy loads that maintain a more-or-less constant impedance at VHF frequencies, and are able to dissipate the power of hand-held amateur radios or low-power mobile rigs. In addition, comparisons are made to the performance of a few commercially available dummy loads, one of which was measured (the MFJ-264 dry dummy).

Back to Basics: The Smith Chart

Basically, the Smith chart is a circular graph (Figure 1) where circles of constant resistance and constant reactance form the grid. The only straight line on the chart is the axis of reals, marked "resistance component," along which are centered the circles of constant resistance (Figure 1a). All the points on a circle of constant resistance have an equal value to where they intersect the axis of reals and represent the resistive component of a complex impedance. Constant resistance circles are tangent to the edge of the chart at the infinite resistance point.

Superimposed on these circles are partial circles of constant reactance (Figure 1b) whose centers lie on a line normal to the axis of reals and are tangent to the axis of reals at the edge of the chart. The layout of the chart allows a complex impedance to be plotted in its two components, a resistive component and a reactive component.

Finally, radial scales complete the Smith chart (Figure 1c). Two scales are calibrated in terms of wavelength, and form the outer ring of the Smith chart. One is measured as "wavelengths toward generator," and the other "wavelengths toward load." The entire circumference of the chart represents one-half wavelength.

All Smith charts have a characteristic impedance of 1 ohm, and are normalized to the characteristic impedance of the system that you are working with. For example, a 50 ohm transmission line has a normalized value of Z/Zo (50/50) = 1. On this scale a resistive 120 ohm load would have a resistive component of 120/50 = 2.4 ohms. In this way, the same chart can be used for any characteristic impedance.

Any impedance, regardless of value, can be plotted on the Smith chart. Impedances can be generally broken down into two components: a resistive component and a reactive component (either capacitive or inductive). These usually take the form of a complex number: $Za = Ra + jXa$, where R represents the resistive (real) component and X represents the reactive (imaginary) component. The sign of the reactive component determines whether the reactance is capacitive (negative) or inductive (positive). The completed Smith chart is shown on Figure 1d. Smith charts are also available in expanded form, which is useful when measured impedances all plot close to the center of the chart, or are already normalized to 50 ohms.

The primary use of the Smith chart in this article is to display graphically the complex impedances measured in the dummy loads at VHF frequencies, and convert these impedances to a more familiar form, the calculated VSWR at the transmitter. A good article on the various uses of the Smith chart, written by Jim Fisk W1DTY, appeared in the November 1970 issue of *Ham Radio* magazine (see "References" at the end of this article).

"It is also important to use only carbon and not wire-wound resistors because wire-wound resistors will become reactive at high frequencies."

Dummy Load Design

Two dummy loads of different design are considered (Figure 2). While a simple carbon resistor remains resistive to several hundred MHz, a dummy capable of dissipating more than about 2 watts must be built from a number of resistors. At VHF frequencies, most multi-resistor dummies become reactive, as well as simply resistive. Therefore, as the frequency increases the design of the dummy load becomes important.

Both dummies are constructed from about 20 2 watt carbon resistors, some double-sided copper-clad board, and an RF connector. I used a type-N connector, but a BNC connector will work, too. UHF connectors should work up to about 150 MHz, but at higher frequencies these connectors may compromise the performance of the dummy. All other things being equal, UHF connectors should not be used, although they are the most common on amateur equipment. It is also important to use only carbon and not wire-wound resistors because wire-wound resistors will become reactive at high frequencies. One dummy, which I call the DIP dummy, consists of a dual-inline arrangement of resistors, while the other is of radial design.

To build the DIP dummy, 22 1.5k 2W resistors and two pieces of double-sided copper-clad fiberboard are needed (Figure 2a). Both are about 5/8" wide; the top board is 5" long, and the bottom board is 6-3/4" long with a tapered end. For the resistors, a total of 22 small holes are drilled in two rows of 11, about 3/8" apart. Solder the resistors between the two boards. You will have to solder all the resistors on one board first, and then fit the other board onto the resistor leads, and solder. Make sure to use a hefty soldering iron, because good solder joints are important. Mount the RF connector in the aluminum box, and solder the tapered end of the bottom plate directly to the center conductor of the RF connector. The top plate is grounded to the box by a sheet of copper foil which can either be soldered directly onto the top plate or bolted through with 4-40 machine screws. The purpose of the tapered bottom plate and the copper foil is to decrease, as much as possible, lead inductance in the dummy. Finally, mount the bottom plate on an insulating stand-off to the bottom of the aluminum box.

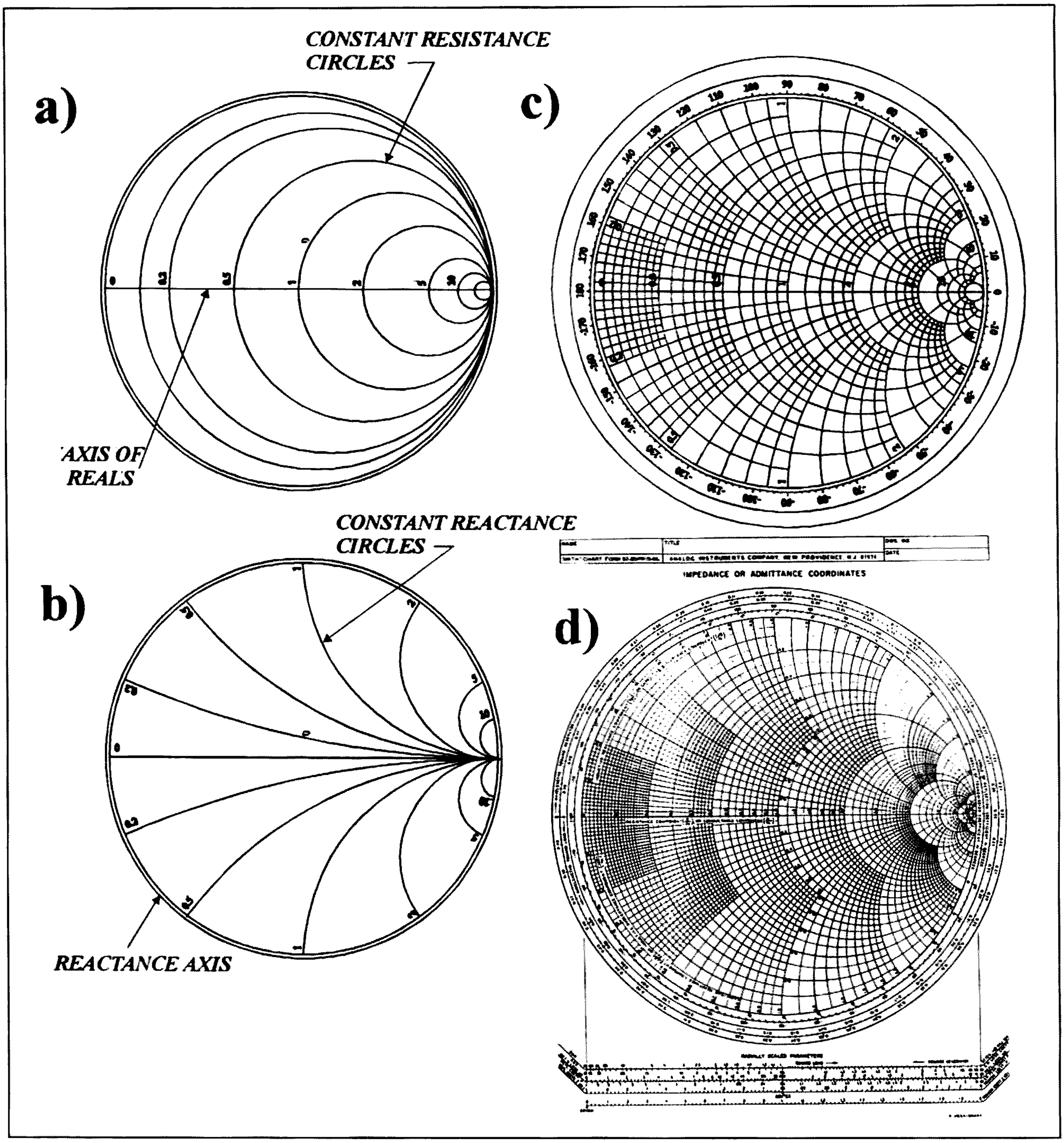


Figure 1. Construction of the Smith chart: a) constant resistance circles; b) partial circles of constant reactance; c) radial scales; d) completed Smith chart. Modified after Fisk, 1970.

The radial dummy is built in a similar manner, except that the RF connector is bolted directly to the ground plate, with the center conductor soldered to the back plate with a piece of large (less inductance) hookup wire (Figure 2b). Twenty 1k resistors are arranged around a 1-1/2" circle. As with the DIP dummy, it would be a good idea to mount the dummy in an aluminum box to help shield the dummy and prevent any grounded surface from contacting the back plate of this dummy, where there will be RF voltage.

Measurement of Complex Impedance

Measurement of complex impedances can be performed with an impedance bridge and a signal generator. An impedance bridge that, with careful attention to construction, should work at VHF frequencies is described by Henry Keen W2CTK. For the dummy antennas in this article, I used an alternate setup which consisted of a Hewlett Packard 608A Signal Generator, a power divider, a couple of 10 dB pads, and a Hewlett Packard 8405A Vector Voltmeter (Figure 3).

In this setup, V_A represents the incident voltage only, because the end is terminated in a purely resistive 50 ohm load and therefore there is no reflection. V_B, however, will represent the vector sum of the incident voltage and the reflected voltage. The ratio

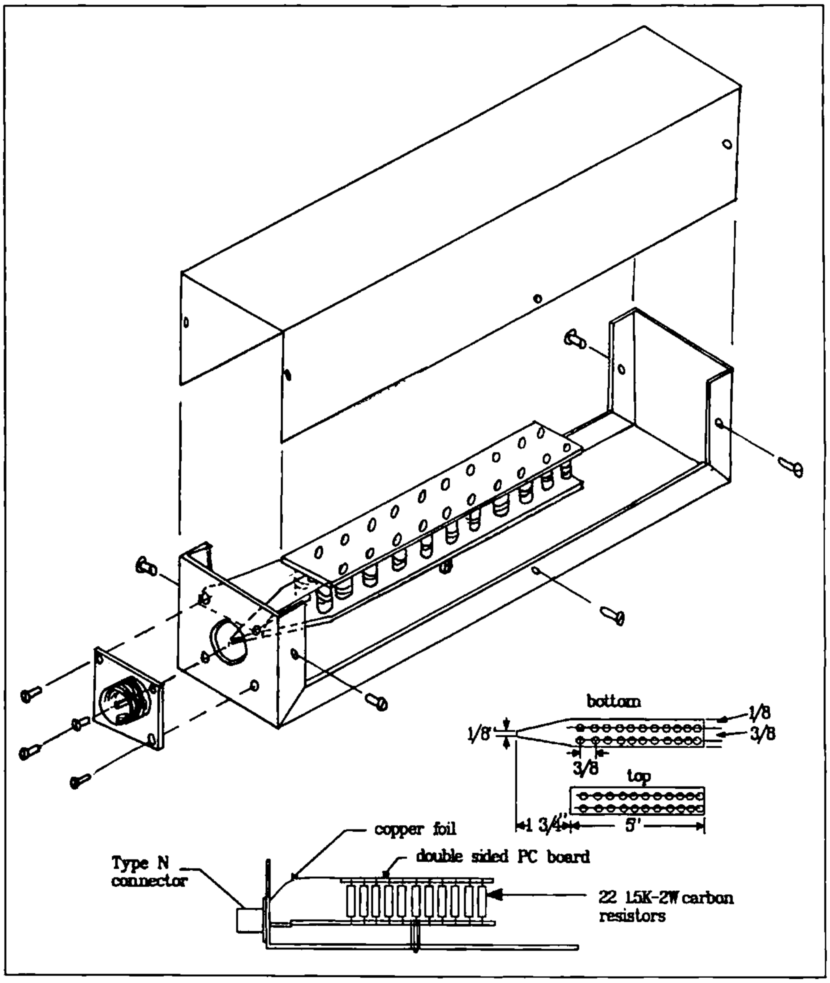


Figure 2 (a). Construction detail of the "DIP" dummy.

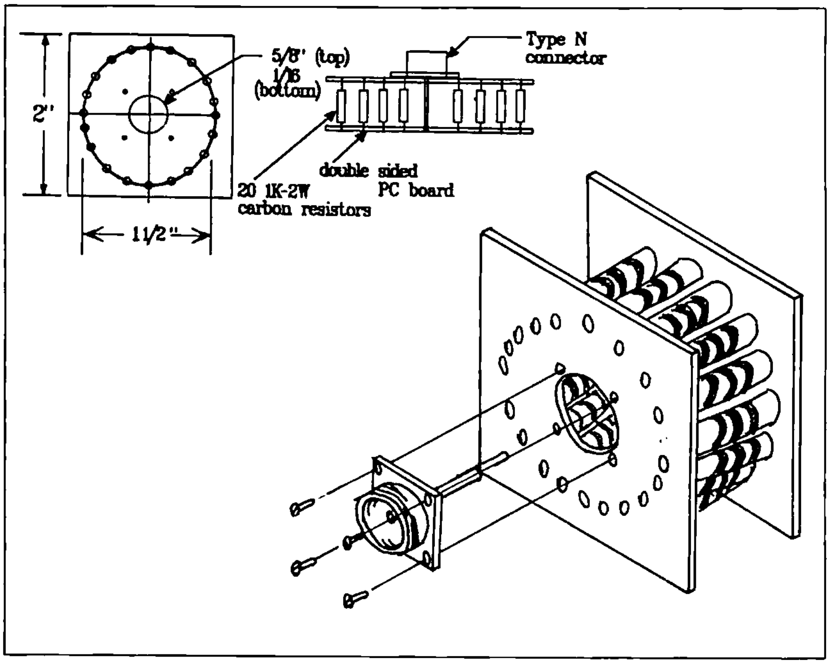


Figure 2. (b) Construction detail of the radial dummy.

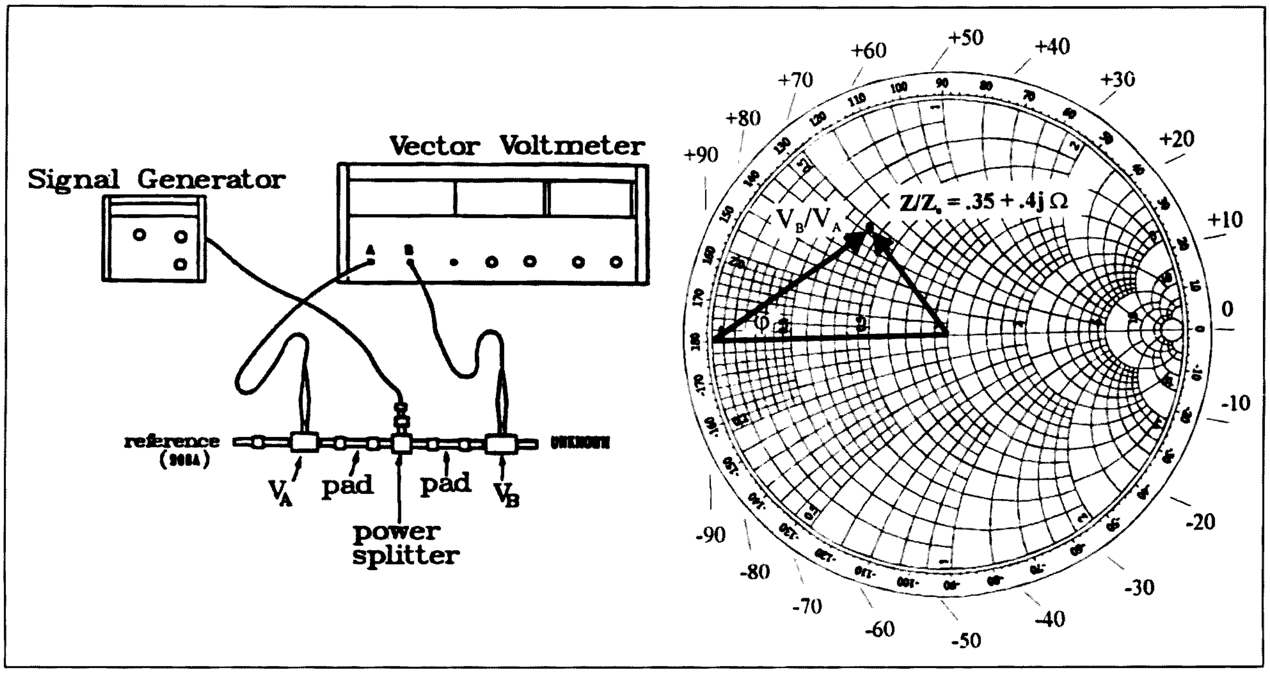


Figure 3. Complex impedance measurement using the Vector Voltmeter.

V_B/V_A is the vector voltage ratio between a 50 ohm resistive load and the load under test. This is the resistive (or real) component of the complex impedance of the load. To find the reactive component, the phase difference (m) between V_A and V_B are measured. If V_B lags V_A, the reactive (imaginary) component is capacitive and the phase difference is negative; if V_A leads V_B it is inductive and the phase difference is positive. These two measurements, V_B/V_A and øB-A, can be plotted on the Smith chart (Figure 3). This task is then repeated for a variety of frequencies to calculate the impedance of the load as a function of frequency.

Results

Measured complex impedances of these two loads are shown in Figures 4 and 5. The DIP load remains essentially resistive up to about 10 MHz, after which it becomes reactive to a maximum VSWR of 1.5:1 at 100 MHz. Because it has a DC resistance of 68 ohms, there is a small mismatch with 50 ohm equipment at low frequencies (VSWR = 1.4:1). The experimenter may be able to get better results at VHF frequencies by simply clipping off pairs of resistors with a pair of diagonal cutters. However, this will probably result in a higher VSWR at low frequencies. This aside, this dummy is surprisingly good, and should be usable up to about

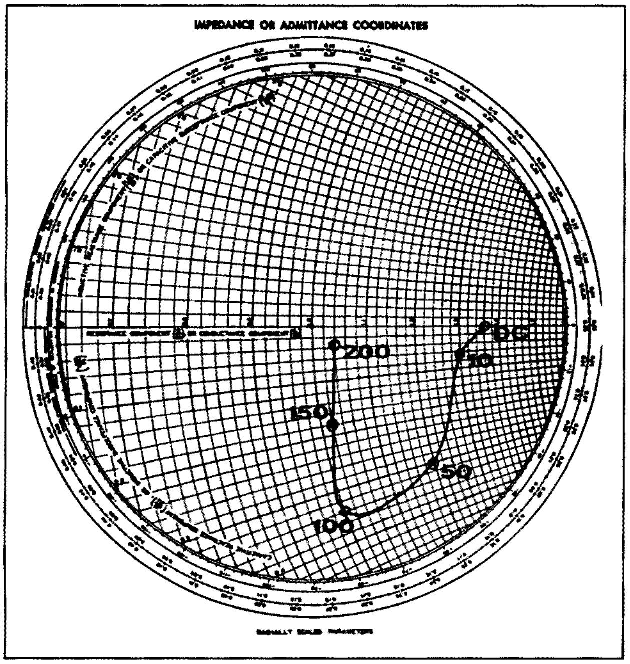


Figure 4. DIP dummy impedance from 0 to 200 MHz. The Smith chart is in expanded form.

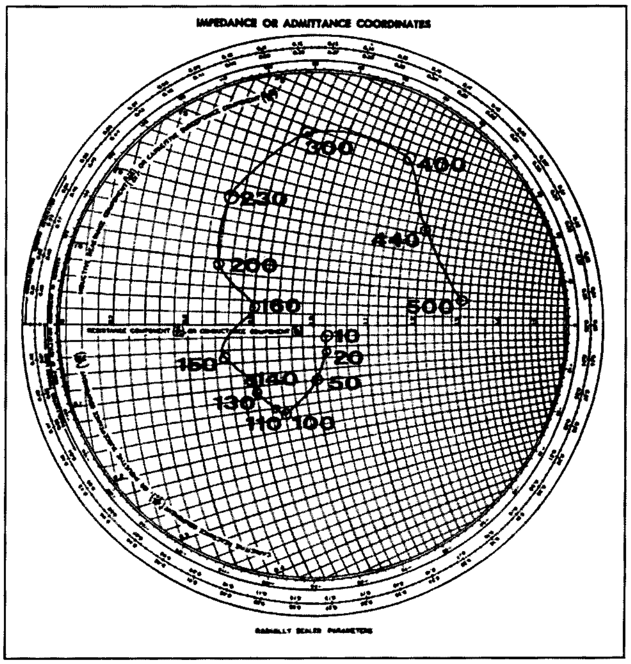


Figure 5. Radial dummy impedance from 10 to 500 MHz. The Smith chart is in expanded form.

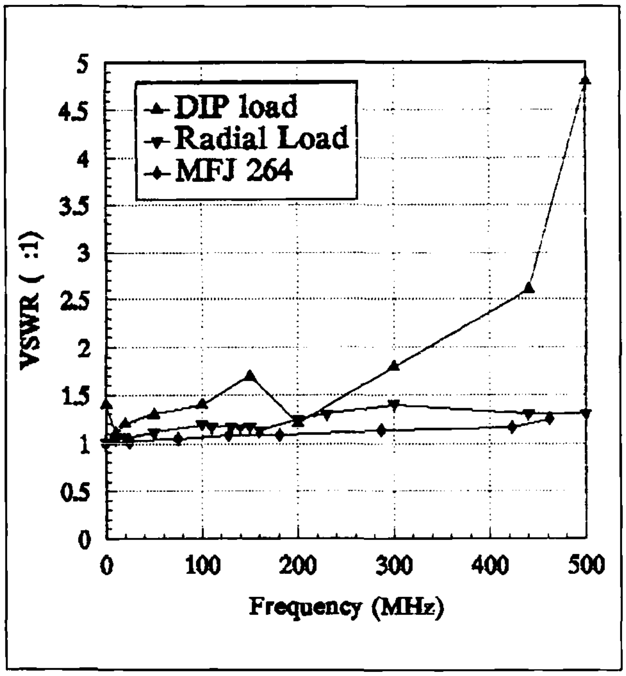


Figure 6. VSWR of dummy antennas at various frequencies. Included for comparison is the MFJ 264 dry dummy.

200 MHz. At 300 MHz (not shown) the dummy becomes very reactive, resulting in a calculated VSWR of greater than 4:1!

The radial load displays excellent characteristics, even well up to the 300 MHz region, reaching a VSWR of 1.2:1 at 300 MHz. At 500 MHz (the limit of my signal generator) the VSWR is 1.3:1.

For comparative purposes—the impedance as a function of frequency of a commercial load—the MFJ-264 was measured in the same way as those constructed in this article. Up to 500 MHz, the VSWR of this dummy remains below 1.3:1, as claimed by the manufacturer (Figure 6). For completeness, a summary of the impedance, etc., of a few other commercially-built dummy loads, along with those described here, are compared in Table 1.

Table 1. VSWR of Dummy Loads from 0-500 MHz

Dummy	0-100 MHz	200 MHz	500 MHz	Power**(W)	Price***
Ten Tec 239	1.1:1*	1.1:1*	2:1*	75	$60
MFJ 260 B	1.3:1*	1.5:1*	—	90	$30
MFJ 262	1.5:1*	—	—	200	$80
MFJ 264	1.1:1 (<1.3:1)	1.1:1 (<1.3:1)	1.3:1 (<1.3:1)	75	$60
DIP	1.3:1	1.1:1	5:1	40	$10
Radial	1.2:1	1.2:1	1.3:1	40	<$10

* Manufacturer's specifications: Where both manufacturers specifications and measured values are available, the manufacturer's values are shown in parentheses.
** Continuous duty.
*** Prices approximate.

Conclusions

Multi-resistor dummy loads at VHF frequencies can be reactive and result in considerable VSWR and mismatch to the transmitter. For this reason, those dummies designed for HF operation may not be suitable for proper tuning of VHF and UHF transmitters. Therefore, design becomes important in that the simple DC resistance of a dummy is not the total impedance presented to the transmitter, especially at VHF. Two designs are offered here that are easy to build and result in a dummy that is usable into VHF, are well below the price of commercial loads of comparable quality. The major drawback of these dummies is that they cannot be used continuously with high-power transmitters. For short periods of time, say up to about two minutes, you can use these dummies with 100W HF rigs but they will get hot. Experience has shown that about two minutes of keydown at 80W will melt the solder on the dummy!

Acknowledgments

I would like to thank the members of the Institute of Space and Atmospheric Studies at the University of Saskatchewan, who were nice enough to loan me their Vector Voltmeter, and always had the time to answer my questions.

References

Jim Fisk W1DTY, "How to Use the Smith Chart," *Ham Radio*, November 1970, p. 17.

Henry Keen W2CTK, "A Simple Bridge for Antenna Measurements," *Ham Radio*, September 1970, p.34.

73 Review

by Bill Clarke WA4BLC

The Drake SW8 World Band Shortwave Receiver

R.L. Drake Company
230 Industrial Drive
Franklin OH 45005
Telephone: (513) 746-6990
Fax: (513) 743-4576
Price Class: $599

A constant companion, at home or on the go!

There are table-top SWL receivers and there are portable SWL receivers. Being a hardware hound, I was never very much impressed by portable SWL receivers. They always seemed lacking in size, weight, sound, etc. Then along came the new Drake SW8, a semi-portable SWL receiver.

What is a semi-portable receiver? First, the term semi-portable is mine, not that of the R.L. Drake Company, manufacturer of the SW8. Second, it is a receiver equally at home on my radio operating table as it is on a picnic table at a campground, on the roof of my car at the airport, or in a motel room.

Physically, the SW8 is not a lightweight (it weighs a little over 10 pounds with batteries) and it certainly won't fit in your shirt pocket. But, it will perform on a par with most table-model World Band receivers costing at and above its price class.

For portable use, the SW8 uses a built-in 41" whip antenna or other external antenna of the user's choice, and is powered by six "D" cells. For fixed use, the unit is powered by an AC adaptor and connected to the world via any number of antenna types that can be connected via PL-259 coaxial connector, or by wire-type terminal connector.

Features

The SW8 comes loaded with top-of-the-line features, yet is so very simple to look at and operate. The front panel consists of an ON/OFF VOLUME control, TONE control, TUNING knob and a multi-purpose key pad. It's similar to its more expensive relative, the R8, but don't let the simplicity fool you—this is a very powerful receiver.

The Liquid Crystal Display (back-lit, amber-colored) shows: frequency, bar-graph-type S-meter, band, AGC, memory, clock, mode, bandwidth, and more. Readability is excellent due to the generous size of the display.

The SW8 receives the shortwave, AM broadcast, FM broadcast, and AM aviation bands (Air Band).

Receive bandwidths are panel-selected at: 2.3, 4, and 6 kHz, making it easy to limit adjacent channel interference.

There are 70 programmable memories which will store all user-selected parameters including mode, frequency, bandwidth, and AGC. These memories can be selected by number or tuning control, and they can be scanned.

A selectable AM synchronous mode reduces the effects of fading.

There is selectable (fast/slow) AGC.

A large carrying handle doubles to hold the front of the receiver up, for viewing ease.

There is AM squelch for the aviation band (on the rear apron).

Direct digital frequency entry is possible via the keypad.

It has an FM stereo headphone jack and an external mono speaker jack.

Antenna selector switches on the rear apron allow the use of several different antennas.

The Manual

The operator's manual for the SW8 is adequate for most users, but it is lacking in specific technical information, block or schematic drawings, and an explanation of the theory of operation. However, the operational instructions are very complete, and at no time was I at a loss in the operation of the receiver.

A convenient log for listing the programmed memories is included in the back of the manual.

Operating the SW8

I found the SW8 very easy and enjoyable to operate. Simplicity is the best word to de-

scribe its operation, but do not equate simplicity to limited performance.

For testing purposes, I used a Carolina Windom antenna (available from The Radio Works, 804-484-0140) at my station location, and a selection of active antennas for portable use. In general, I found the built-in whip antenna to be of limited use for world-band reception. It was, however, excellent for AM and FM broadcast and the Air Band.

I was first impressed by the receiver's excellent tonal quality. There is a real presence to the sound reproduction and the TONE control has real authority. Voices seem to leap out at you.

The receiver is very quiet, with no discernible internally-generated noise from the microprocessor (an unfortunate side effect too often heard in modern receivers).

There are three methods of direct frequency selection on the SW8:

1. Selection can be made by manually rotating a tuning knob.

2. Or, press the UP or DOWN frequency buttons that step through the bands at 10 kHz or 9 kHz (selectable on the AM broadcast band), 100 kHz on the shortwave bands and FM broadcast band, and 12.5 kHz on the Air Band. Digital readout is displayed to 100 cycles. Stepping is continuous while either button is held down.

3. Also, you can use direct digital entry via the keypad. This is extremely handy for quick movement from one frequency to another.

Strong adjacent channel interference can be reduced by use of the ATT (attenuate) control and proper selection of bandwidth. To some extent the audio TONE control will help also.

The receiver selects the proper antenna for the band chosen, based upon selections made from switches on the rear apron. For example, I connected the Carolina Windom to the SO-239 connector as antenna one and switched the shortwave antenna select switch to #1. I then put the FM/air antenna select switch on whip. Thus, when changing from shortwave to FM broadcast or the Air Band, the receiver chooses the correct antenna.

Although not used in this test, the #2 antenna connector is designed for wire termination and provides connection for 300 ohm VHF antennas and a choice of 500 or 50 ohm shortwave antennas. *[Manufacturer's Note: Although it is not marked on the cabinet, this unit also has a balun on the VHF antenna terminals. You can attach a 75 ohm antenna by connecting one lead to either terminal and the other to ground.]*

The beep tones produced when the keys are pressed helps to monitor what the receiver is doing. For example, the beeps are coded by length and note to indicate different functions or error conditions.

My test site is located about 14 miles from two regional airports (one shared with a military reserve unit). I found no problems in receiving most aviation-related communications using the built-in whip antenna. For a quick check of the current weather conditions at the airports, I switched to the Automated Terminal Information Service (ATIS) frequency.

"It does its job very well and has outstanding audio. It will serve well on a desk, and being portable only makes it more versatile."

When listening to international broadcasts I found that the choice of bandwidths aided considerably in interference elimination. Also, there were times when I used the ATT control. The fidelity from the speaker was very pleasing to me, particularly when listening to music (true not only for shortwave, but for local broadcast also). The AM SYNCHRONOUS feature does very well in reducing the effects of fading; however, the receiver's frequency must be set very accurately for proper use. If you set the frequency incorrectly, you will be reminded by a whistling sound.

Using SSB (single sideband), I was able to listen to the amateur radio bands. This allowed me to monitor the various nets I participate in, while away from my station. Here again I noted that the audio appeared to really jump out at me.

The 70 memory locations are all user-programmed and will store frequency, mode, bandwidth, AGC setting, attenuator selection, and synchronous detector (if chosen). When a memory is selected, the tuning knob can be used to tune up or down from the memory frequency.

Scanning is done by memory block, by time. There are six blocks of 10 memories each. Each frequency is checked for five seconds. Memory positions can be tagged for SKIP, and will not be checked during scanning.

The internal clocks (two 24-hour units) allow for local and UTC time to be selectively displayed. I set them to WWV, and when I rechecked them two weeks later, they were on the money. The times can be set to act as a clock radio with wake-up and good-night features, or as event features capable of selecting specific memories at user-programmed times.

While testing the receiver in preparation for this review I found the SW8 could easily become a constant companion. It was my alarm clock, window to the world, monitor of the HF amateur radio bands, airport buddy, and reproducer of Country Western music when I tired of all else.

Recommendation

Drake has done a nice job with the SW8 receiver. It does its job very well and has outstanding audio. It will serve well on a desk, and being portable only makes it more versatile.

I do, however, have two recommendations for improvement to the receiver:

1. Provide a means of covering the selector switches on the rear apron to make them dirt- and sand-proof.

2. Install a preamp for use with the built-in whip antenna when tuning the World Bands.

Overall, I can comfortably recommend this receiver. It does what it is supposed to, and does it with class!

Specifications

Frequency Range	500-30,000 kHz (0.5 - 30 MHz) 87-108 MHz (commercial FM band) 118-137 MHz (aviation band)
Modes	AM, USB, LSB modes (0.5-30 MHz) AM mode only for 118-137 MHz FM mode only for 87-108 MHz
Sensitivity	SSB: <.5 µV (.5-30 MHz) AM: <2.0 µV (.5-30 MHz) AM: <4.0 µV (118-137 MHz) FM: <4.0 µV (87-108 MHz)
Frequency Stability	+/-10 ppm (0-50 degrees C)
Frequency Accuracy	#+/- 100 Hz (at 25 degrees C)
Selectivity AM/SSB	6 kHz at -6 dB (<12 kHz at -60 dB) 4 kHz at -6 dB (<9 kHz at -60 dB) 2.3 kHz at -6 dB (<5 kHz at -60 dB)
IF Frequencies	AM/SSB 1st IF: 55.845 MHz 2nd IF: 455 kHz FM 1st IF: 10.7 MHz (single conversion)
Image Rejection	>60 dB (.5-30 MHz) >60 dB (118-137 MHz) >50 dB (87-108 MHz)
IF Rejection	>80 dB (1st IF) >80 dB (2nd IF)
Dynamic Range	>95 dB at 20 kHz spacing SSB 2.3 kHz bandwidth
IP3 Intercept Point	>+10 dBm at 20 kHz spacing >-20 dBm at 5 kHz spacing
AGC Performance	Threshold 1.0 µV Attack Time 1 mSec Release Time Slow: 3 sec Fast: 300 mSec <4 dB change in audio output for 100 dB RF input change, referenced from the AGC threshold point.
Internal Antenna	41" metal telescoping whip (all bands)
Antenna Inputs	0.5-30 MHz: S0-239 (50 ohm coaxial connector) or three-terminal compression connector for either 50 ohm or 500 ohm and ground connection. 87-108 MHz: 300 ohm balanced input 118-137 MHz: 300 ohm balanced input
Audio Output	2.0 watts into 4 ohm speaker at less than 5% distortion with a 9 VDC supply voltage. Line audio output is 300 m Volts at 4.7k ohms.
DC Power Requirements	Input: 7-10 VDC at 1 amp. Can be supplied from AC Adaptor, external DC power supply, or (6) internal "D" cells.
Operating Temperature	00 to + 50 degrees C
Weight	10 lbs. (includes AC Adaptor, batteries NOT included)
Dimensions	11.5" x 5.25" x 13" (WHD)
AC Adaptor	Input 120 VAC at 15 watts, output 9 VDC at 1A (as supplied)

73 Review

Number 9 on your Feedback card

by Larry Antonuk WB9RRT

JPS Communications, Inc.
P.O. Box 97757
Raleigh NC 27624-7757
Telephone: (919) 790-1048; Fax (919) 790-1456
Order line (800) 533-3819
Price Class: $249.95

JPS Communications' NRF-7

Clean up your audio with state-of-the-art DSP!

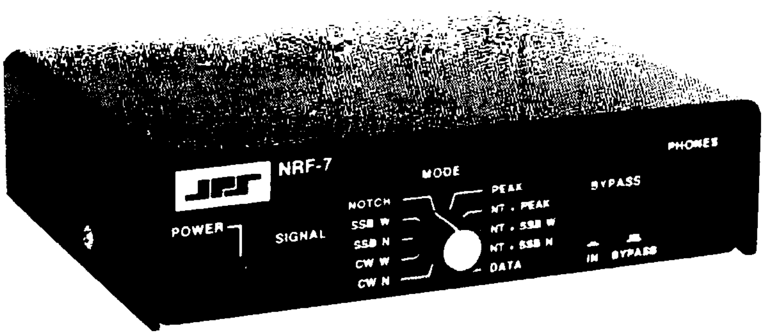
"Real hams don't use audio filters." This was the prevailing wisdom, at least until a few years ago. If you were using an "add-on" audio CW filter, for instance, it simply meant that you were too cheap to spring for the optional narrow crystal IF filter that went into your rig. Even worse, it might have meant that your rig was so cheap that it didn't even have an option for different IF bandwidths! Heavens!

A narrow crystal IF filter was obviously the way to go—as long as money wasn't a concern. An IF filter would produce steeper "skirts" than an audio filter, and prevent adjacent signals from overloading the AGC circuits and wiping out your receiver entirely. Audio filters were also prone to "ringing." While they might enable you to pick signals out of a pile-up, the very act of listening to a cheap audio CW filter for an entire contest could drive an operator bananas. (Imagine listening to someone hitting a steel pipe with a wrench—with your head underwater.)

It's hard to get rid of preconceived notions, but audio filters are not what they once were. The main reason, of course, is that it's now a digital world. The NRF-7 from JPS Communications makes use of technology that was non-existent (or economically unavailable) just a few years ago. But what makes a digital audio filter better than a conventional analog audio filter?

The main function of a filter is just what the name implies—it filters out unwanted signals. An IF filter does this at the IF frequency by providing a low impedance at the main IF frequency, and higher impedance as the frequency varies from the center frequency. Obviously, the faster the impedance goes up as the frequency varies from the main IF frequency, the sharper the response of the filter (the steeper the "skirts"). In other words, the sharper the filter response, the thinner the "slice" of band that the filter will pass.

An audio filter works in a similar manner, except that it operates on the audio tones from the speaker rather than the IF frequencies. For instance, an audio filter configured for CW might have a center frequency of 800 Hz. It will provide little or no attenuation at 800 Hz, but the attenuation will increase



greatly at 750 and 850 Hz, increasing as the tones move away from the center frequencies.

The ideal filter would have attenuation that would increase to infinity as soon as the desired cutoff frequency was reached (a vertical "skirt"). In the reality of analog circuitry this is not possible, due to circuit design considerations, component tolerances, and financial problems. In either the IF or the audio filter, then, the attenuation increases gradually, rather than sharply, as the frequency moves off from center frequency. But what if we didn't have to deal with the design problems of filters made with toroids, or active IC circuits? What if we were just dealing with numbers? As an example, what if instead of filtering the audio signal we just fed it into an analog-to-digital converter, and wound up with a stream of numbers? We could then analyze the stream of numbers and determine what was useful, and what wasn't.

In our CW example, we could just check and see what numbers were part of the 750 to 850 Hz bandwidth that we desired. If a number came along that wasn't part of this desired slot, we'd just toss it out. We could then feed the stream into a digital-to-analog converter, and reconstruct the audio. A microprocessor would be able to make the necessary decisions at an extremely fast rate—much faster than the audio frequencies involved. In addition to decisions on bandwidth, the system can also identify unwanted carriers or white noise, making for an exceptional filtering system.

Features

The preceding discussion provides an extremely simplified explanation of Digital Signal Processing (DSP), the main component of the JPS NRF-7. This is the equivalent of saying "Exploding fuel makes an automobile move." It's true, but somehow you get the sense that it's a little more complicated than that. The best part about DSP is that you don't really have to know anything about Fourier transforms and sampling rates to appreciate it—any more than you need to know about fuel injection in order to drive to work in the morning. As a matter of fact, installation of the NRF-7 is a lot easier than driving to work in the morning. RCA-type jacks on the rear of the unit connect to the receiver output and the speaker, and a coaxial power plug is used to provide 12 VDC to the unit. Once hooked up, the front panel power switch controls the on/off function, a mode switch lets you select the type of filtering to apply, and a bypass switch lets you take the filter in and out of the circuit.

The 10-position mode switch allows various combinations of SSB and CW filters, both wide and narrow, along with notch, peak, and data filters. Filter use is best accomplished by first leaving the filter out of the circuit, and tuning in the desired signal. A front panel signal LED provides a means of determining if the signal is in the desired passband—simply tune until the LED flashes along with the signal of interest. At this point, select the proper mode and press the bypass button, activating the filter. The LED will continue to blink along with the desired signal, but the vast majority of surrounding signals will be gone. (When listening to a CW signal in a pileup, it's difficult to remember that the BYPASS button is hooked to your filter. It seems more like it's hooked to the power plugs on all of the offending transmitters!) Obviously, the filter can be left in as you tune along, but It's nice to put it in and out of circuit, if only to keep in mind how much of a dramatic difference it makes. CW operators will have a choice of 400, 800, or 1000 Hz center frequencies to accommodate rig variations and personal preference.

In addition to the CW and SSB modes, the NRF-7 also has a DATA mode. This mode uses a passband of 500 Hz, centered at 2200 Hz to accommodate standard RTTY mark and space tones. The DATA mode is just as impressive as the CW mode. During tests of the unit during a recent RTTY contest, it was impossible to tune in more than one signal at a time, even in intense pileups.

The other two modes available are PEAK and NOTCH. The PEAK mode provides a constantly varying peak around whatever signal happens to be in the passband, reducing the audio bandwidth to the minimum required for the given signal.

The NOTCH function is one of the more interesting features on the filter. Your first response after flipping to the NOTCH position might be "Hey . . . where's the notch adjustment??" In other words, how do you adjust the frequency of the notch? Well, you don't. The DSP chip knows what a carrier sounds like, and simply removes it. Or them. No trying to fiddle with the notch control, or shifting the receiver IF—the tones just disappear. As a matter of fact, tune to a CW pileup, hit NOTCH, and all you'll hear will be a series of clicks. The DSP circuitry gets rid of all of the tones in the audio, leaving just a short click as the filter starts to kick in. Obviously, this means that there is no way to use the NOTCH filter in the CW or DATA modes, but due to the performance of these filters the NOTCH filter isn't necessary.

The only drawback noted in the entire review process relates to the fact that the NRF-7 is designed to be placed in-line with the speaker audio. In fact, it has a built-in 2 watt amplifier to drive the speaker you disconnect from your rig (and headphones, via the front panel jack). This works well for the CW and SSB modes, but for us RTTY fans it presents a problem. Audio from the filter needs to be passed to the RTTY decoder, such as a PK-232, but then there's no way to hook up a speaker. If you normally use headphones this doesn't present a problem, but you may have to hook up a small switching or pad arrangement to make things work with both a speaker and decoder. A second output port on the NRF-7, perhaps at line level, would have made interfacing a little easier for AMTOR, RTTY and HF packet types. Provisions are made, however, for changing the input impedance to a high or low level by on-board resistor changes.

The only other shortcoming is the fact that the NRF-7 is indeed an audio filter. While it can do some truly amazing things with receiver audio, it won't help the actual selectivity of the receiver. In other words, you might be carefully separating two QRP CW signals when some guy kicks in his kilowatt, 200 Hz up the band. Your QRP signals are history. In the same manner, the unit won't make up for front-end deficiencies in a cheap receiver. The NRF-7 is pretty amazing, but it won't do miracles.

Documentation

Documentation with the unit is adequate, even more than might be needed due to the simplicity of operation. A troubleshooting chart is included, listing most of the basic problems likely to be encountered when first hooking up a perfectly good unit—the plug-in power supply is bad, you've used the wrong audio plug, the speaker connections are tarnished, etc.

If things are a little more serious there is a schematic included, but It covers only the power supply and audio input/output sections. (The actual Digital Processing Section is shown only as a block diagram since, according to the manual, the digital section is "virtually impossible to troubleshoot without highly specialized equipment." Well, sure, but what isn't these days?? As it turns out, the factory *will* send a complete digital schematic to any product owner who is interested enough to ask for one. in any case, there's no reason to be overly concerned with repairs—the NRF-7 is very well built, and is covered by a one-year parts and labor warranty.

The Coleman (Mini)-Kilowatt

Extend your station's working range for next to nothing.

by Steve Katz WB2WIK/6

Whenever you use a lengthy transmission line to connect a radio to an antenna, you can expect to encounter considerable loss. Even the very best commonly-available cable for UHF/SHF pioneers (7/8" diameter hardline) is costly, heavy, requires expensive connectors, and still has measurable losses. Most of us, even those with multiple feedlines and limited budgets, aren't using cable that good. We're using RG8/U, RG213/U, 9913, 9086, 9096, or some similar 0.405"-diameter 50 ohm transmission line which is nearly lossless at lower frequencies, but measures more loss than most of us would like to have at VHF or UHF.

If you're using 50 feet of feedline, it's probably no big deal unless you're operating at 1.2 GHz or higher frequencies. But if your setup is anything like mine, you're using hundreds of feet of coax to feed each antenna because you have a tall tower or antennas far away from the shack. Thus, you are undoubtedly encountering considerable feedline loss, which limits your station's capabilities.

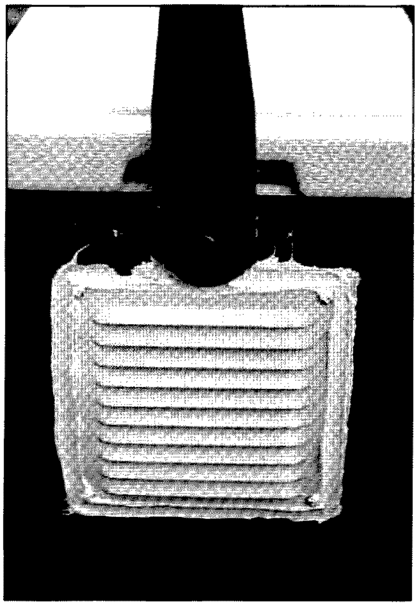


Photo A. Close-up of one of the Coleman's side vent covers. Note the thorough caulking job.

Most satellite enthusiasts and moonbouncers use masthead preamplifiers to boost received signal levels at the antenna feed point, thus overcoming transmission line losses on receive. But even these folks rarely locate their transmitters at the antenna, which in many cases could boost transmitted ERP (effective radiated power) by 3 dB or more, because the transmitting equipment is more bulky and normally not weatherproof. Who wants two inches of water inside their $500 transmitter?

My Solution

Luckily, there is a solution to this problem, and it's easier than you might think. I have a VHF simplex autopatch installed at my home. It uses a conventional 2 meter FM rig and a simplex patch interface between the rig and the telephone line, and allows me to make non-business, no-cost telephone calls from my car as long as I'm within range of my home station. (In my case, this can be a large radius, since my home station antenna is quite high.) The problem is, the patch gear is set up in the shack, while its antenna is atop a 40-foot tower, up on a hill behind my house. This means using a transmission line more than 250 feet long. I could have put the whole "patch" station up on the hill, closer to the antenna, but this would mean losing local control of the rig. There are new, very costly radios that allow full remote-control of all functions, but I don't own one of these and didn't want to shell out more than $1,000 for a radio that doesn't work any better in most respects than my old $250 rig. Plus, I don't know how well the radio would work if installed in a severe environment (like outdoors). It doesn't get very cold here, but it does get mighty hot. If I installed a rig inside a weatherproof box it might reach 150 degrees F or higher on a sunny day, even if the box were well-ventilated.

My situation isn't unusual. Many of us hams use antennas located a distance from our homes, and some of us have really tall towers. In either case, a long and lossy feedline is required. Here's my solution:

I purchased a Coleman 28-quart cooler with a tight-sealing lid for $20 at a local discount store. It was just large enough internally to house a solid-state power amplifier/RX preamplifier combination and a 12V power supply. Thermos, Igloo and others make similar coolers. Shop around for your own deal. Even huge coolers with 40-quart

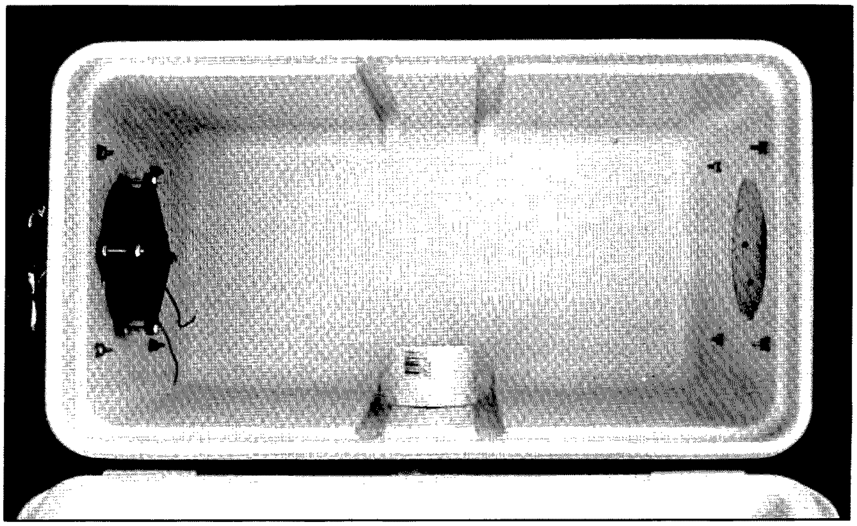


Photo B. The Coleman (Mini)-Kilowatt under construction. The cooling fan can be seen at one end-side vent hole, and a 4" hole is directly opposite.

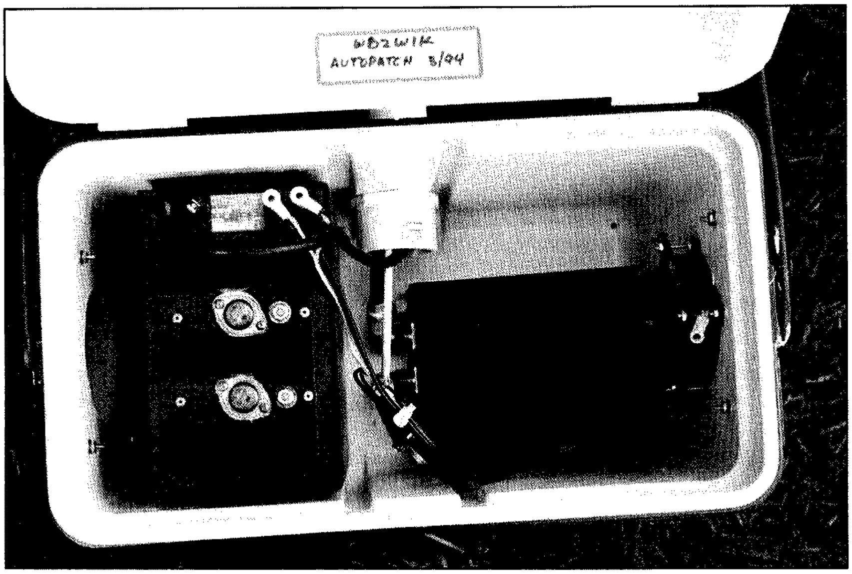


Photo C. Inside the cooler, with the 12 volt power supply and the 80 watt amp/preamp installed. Everything fit with room to spare. A larger cooler could likely accommodate a real *kilowatt amplifier.*

or larger capacity cost less than $40. They are all thermally insulated, reasonably weathertight, and rugged enough to be installed outdoors permanently.

Because these coolers are normally sealed tight when their lids are closed, heat generated by the equipment they contain will build up to destructive levels unless some provision is made for cooling. I purchased a couple of small vent covers which had louvers and metal screening already preattached. After cutting suitable vent holes in both sides of my cooler, I installed the vent covers over these holes with the louvers on the outside and facing downward, to prevent rain from entering the vents (see Photo A). These vent covers cost 99 cents each at a local discount home supplies store. After cutting a 4" diameter hole in each side of the cooler using a portable jigsaw (the cooler materials cut very easily—they're just PVC and styrofoam), I mounted the vent covers using four 2-1/2" #8 stainless-steel bolts each, with lockwashers and nuts inside the box. Then I used weatherproof window caulking compound (GE, Dow, DAP or whatever, from a tube) to caulk all around the small cracks between the vent covers and the cooler itself.

I mounted a small cooling fan inside the cooler, over one of the vent holes, to exhaust air out that vent (see Photo B). When the cooler cover is closed, the fan draws outside air in the opposite vent and blows air out the vent over which the fan is located. This means the temperature inside the cooler will always be about the same as the air temperature outside. (Those of you living in extremely cold climates might wish to block the vents off during the winter season and then open them during the summer. Another option would be to add some type of heating unit to the project.)

See Photos C, D and E. To allow access to and from the equipment contained by the cooler, I used 2-1/2" diameter PVC water fittings. A short, straight section of threaded PVC pipe passes through the rear wall of the cooler and joins to a 90-degree PVC elbow attached to it on the outside of the cooler. Since I used pre-threaded PVC, this just screwed together. If you can't find threaded PVC accessories, use unthreaded pieces and glue them together with the specialized cement sold just for this application. The outside elbow faces downward to prevent rain from entering, and is large enough internally to pass three or four cables. The hole for the PVC inlet/outlet pipe was also quickly cut with my jigsaw, and the straight PVC section is held in place with an internal threaded PVC nut. The exit point is weather-sealed with window caulking, just like the vents. If you use similar procedures, be sure to allow at least 12 hours for the caulking to fully cure before proceeding with other work.

Installing the Electronic Guts

Once the vent covers, fan and PVC pipe are in place and the caulking is cured, it is time to install the electronics. I used a Mirage B108G 2 meter power amplifier/RX preamplifier combination. This "brick" runs 80 watts output power when driven by 10 watts, and contains an RF-switched GaAsFET receive preamplifier with about a 1 dB noise figure. It requires about 12 amperes at 13.8 volts DC for power when transmitting, and I used a Kenwood power supply I happened to have on hand. An Astron RS-20 or similar commercial unit would have done as well and also fit in the box. The DC power supply requires only about 3 amperes at 117 VAC for line power, so it can be supplied by a very long #12 or #14 gauge line cord.

There's no sense in putting the amplifier in the field and running DC power up to it, since the DC load current is so high. My modest little 80 watt (output) amplifier "brick" requires 12 amperes, and a larger solid-state amp will require much more. (The popular 160-170 watt bricks all consume about 25 amperes at 13.8 VDC.) If I had run DC from the shack all the way up to the box, I would have needed #10 copper conductors as a minimum, preferably #8 or #6. This is very heavy and costly wire that isn't even commonly available in paired conductors with a weatherproof covering. By putting the DC power supply in the box with the amplifier, I could use inexpensive #12 or #14 outdoor AC extension cord, like that sold for outdoor garden tools (electric lawn mowers or hedge clippers). Two 100-

Photo D. Close-up view of the cables exiting the PVC pipe feed-through. The gaps in the pipe are filled with foam-rubber gasketing material, my "Black Widow Protection."

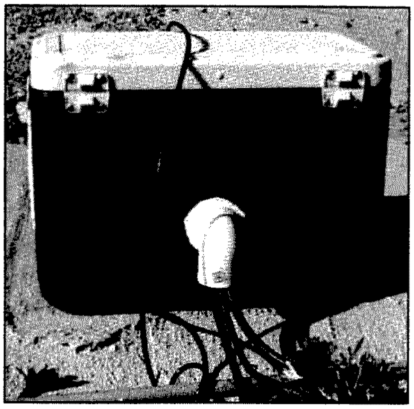


Photo E. The completed Coleman (Mini)-Kilowatt as it sits on the ground alongside the base of the antenna tower to which it's connected.

foot extensions cost only $26 total and these are very weatherproof, with a tough rubber jacket that even resists garden "critters" with sharp teeth! (Note: For a permanent installation that meets existing electrical codes, you'd need to use wiring inside a metal conduit. But I consider my installation "temporary," like using an electrically-powered garden tool, and therefore use outdoor extension cords instead. In a semi-rural area, anyone can get away with this.)

As you can see in the photos, everything fit in the box quite nicely. Before installing the cooler at the antenna site, I checked it for water leaks (with the cover closed, of course!) by spraying it with a garden hose from various angles. I found the cover did leak a bit, and there was no place for water to exit the box, so I drilled half a dozen 1/4" holes in the bottom of the box, at the lowest points inside the container, to allow any water that leaks in to exit quickly. A second "garden hose" test revealed that this solution was a good one. Another solution might be to use duct tape to seal the lid of the cooler once it's closed, and not drill any "weep" holes.

This whole project took maybe an hour to complete, not including the 12-hour cure cycle for the caulking, and cost $35 (not including the electronic equipment). After installing the cooler "up the hill" near the base of the autopatch antenna tower, and having the AC line cord plus the coaxial input and output lines routed through the PVC elbow and connected, I pushed some foam-rubber weatherstripping material into the remaining voids in the PVC pipe. This was done in hopes of keeping insects out of the box. Tiny insects like fleas or gnats might still enter through the holes in the window-screening material at the vents, but I was more concerned with black widow spiders, common in these parts. Black widows are too large to pass through the window screens, but might've entered the PVC pipe. I don't want any "surprises" the next time I open the lid of the cooler!

To keep the cooler from moving much during an earthquake, or from disappearing altogether in the event "visitors" with vandalous intentions happen to spot it in my yard, I attached the box to a nearby irrigation pipe (3/4" galvanized—pretty strong stuff) with a steel bicycle anti-theft cable, as shown in Photo E, using a padlock. If you install your Coleman (Mini)-Kilowatt in an unprotected yard or alongside your tower, you might consider taking some similar precaution.

The Results

Was this small project worth the effort? You bet it was! My original autopatch system, with a rig running 40 watts in the shack, had an effective radiated power of 60 watts, factoring in feedline loss and antenna gain. By adding the remote amplifier, its ERP is now 260 watts, a 6.4 dB improvement. Had I located the same amplifier in the shack, instead of near the antenna, the resultant ERP would have been 115 watts, or 3.5 dB less effective power. Now I have only about 0.8 dB feedline loss between the amplifier and the antenna, whereas with a shack-mounted amplifier the loss would be 4.3 dB.

And how about on receive? With the shack-installed rig, my receiver sensitivity was 0.48 µV for 20 dB noise quieting (this is 0.28 µV, degraded by 4.3 dB of transmission line loss). Now, with the remotely-located preamp in the B108G, my receiver sensitivity is 0.32 µV for 20 dB quieting. This is a receiver sensitivity improvement of 3.5 dB. The system can now "hear" much weaker signals than it could before. Had I installed the receiver preamp in the "shack," the resulting improvement would have been essentially zero, since the preamp noise figure and the original rig's noise figure are about equal. (No amount of preamp gain makes any difference unless the noise figure is improved.)

In all, I've improved my system performance by 7 dB: 3.5 dB on transmit, and 3.5 dB on receive. The difference in working radius for the autopatch system described is several miles. I can now access and hear the "patch" from many places farther away than previously. All this improvement cost was $35 for the cooler, modified as described, and $26 for extension cords to power the equipment. A mere $61 total investment. I could have raised the antenna another 50 feet to yield a similar improvement, but at 10 times the cost.

Whether you have an autopatch system, or just want to extend your working range for normal simplex modes (FM, SSB, packet, etc.), remoting your final power amplifier and receiver preamplifier will help. One precaution I should mention is to be sure the AC extension cord is plugged into a "GFI" outlet, or protected by a GFI circuit-breaker. GFI stands for "ground-fault interrupter," and this is not only prudent for any AC power line used outdoors, but is an electrical code requirement nearly everywhere. A GFI might occasionally "trip" on rainy days, rendering your remotely-located equipment powerless until it's reset, but the protection afforded against accidental electric shock is well worth the possible nuisance.

I don't know about you, but I like almost-free station improvements. I picked up 7 dB for $61. This is $8.71 per dB, an excellent return on investment. And after all, this is only a hobby. 73

HAMSATS

Number 11 on your Feedback card

Amateur Radio Via Satellites

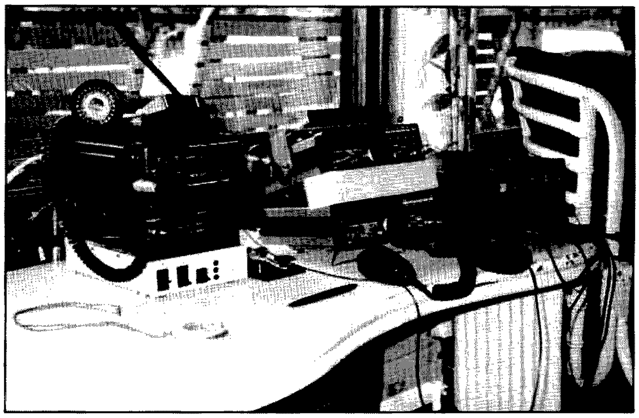


Photo A. Portable satellite rigs for 15, 10, 2 and 0.7 meters.

Andy MacAllister WA5ZIB
14714 Knights Way Drive
Houston TX 77083-5640

Satellite Portable

I go fishing at least once a year with a small group of friends. The goal is to get away from the city, while chasing fish is secondary. We use ham radio to communicate between boats and always try out some new idea for satellite chasing after a day out on the water.

This year a new antenna from Cushcraft looked like a good candidate for portable hamsat work. The antenna is a dual-band, linearly-polarized yagi called the A270-10S. It has five elements on 70 cm and five on 2 meters. The two yagis are mounted in the same plane, but on opposite sides of the boom. The antenna comes with aluminum components, stainless hardware and a wiring harness allowing a single coax cable feed. While this arrangement is fine for dual-band rigs, separate feedlines were more appropriate for the multimode single-band rigs on hand.

Antennas tried in previous years for 2 meters and 70 cm included short crossed-dipole systems from KLM and Cushcraft, small quads from Lightning Bolt Antennas, ground planes from Lakeview, and even an AEA HR-1 telescoping half-wave HT whip. All of the antennas tried have been useful, depending on the satellite and local working conditions. While the ground planes did well for low-earth-orbit (LEO) satellite contacts, they were quite difficult to use for AMSAT-OSCAR-13 in its high elliptical orbit due to the weak signal levels. Crossed yagis were better for A-O-13 due to their polarization compatibility and higher gain, but they were harder to transport and, due to the lack of rotators, very difficult to use for LEO hamsats.

The short dual-band yagi from Cushcraft provided several A-O-13 contacts from a camera tripod mount. The antenna was mounted near its balance point rather than at the rear. To help make up for the antenna's lack of gain, a good quality preamplifier was used on 2 meters and a 100-watt linear employed for the 70-cm uplink. Antenna alignment was accomplished with a compass from the Scout shop and an inclinometer from the hardware store. Aiming predictions were printed prior to the trip.

Contacts were few on the low-orbit satellites using this antenna, due to a lack of rotators or volunteers. For a small home installation some very inexpensive rotators could be incorporated for azimuth and elevation because of the light weight and small size of the A270-10S. As a portable or emergency VHF/UHF satellite antenna, it's a good performer.

RS-12

While the contacts on A-O-13 were fun to make using the simple portable system, chasing RS-12 was like getting back to the days of Sputnik-1 but proved to be more difficult than anticipated. RS-12 is currently running Mode K, the HF mode, which calls for a 15 meter uplink and a 10 meter downlink. Sputnik-1 transmitted just above 20 MHz. At our lakeside station, a NCG Co. Model 15M mobile transceiver was tried with a modified "CB" magnet-mount, base-loaded whip for the uplink. A Uniden HR-2510 transceiver and a dipole were used for reception. Downlink signals were strong, but the low-power output of the NCG 15M did not produce any contacts. We could hear the resulting downlink from our 15 meter transmissions, but were not having any luck catching the attention of others.

As the upper shortwave bands decline in long-distance usefulness due to the present sun-spot cycle, the use of Mode K gets easier. Activity on the satellite has increased dramatically and it has become harder to compete for a contact.

RS-12 is part of a larger civilian navigation satellite, COSMOS 2123, launched by the former USSR on February 4, 1991. RS-13 is another part of the system, but is not currently in use. RS-12 is capable of three different modes including "A" with a 2 meter uplink and 10 meter downlink, "T" using 15 meters up and 2 meters down, and K. The satellite is also able to run dual simultaneous modes using "KA" or "KT." Almost since launch, however, RS-12 has been running K.

The K transponder system on RS-12 is 40 kHz wide and non-inverting. This means that an upper sideband (USB) signal sent by a ground station high in the transponder input band will come out as a USB signal, high in the transponder output band. For RS-12, the uplink band goes from 21.210 to 21.250 MHz, and the downlink is from 29.410 to 29.450 MHz. The main CW telemetry beacon can be heard on 29.408 MHz. Unlike other hamsats, RS-12 transponder operation requires at least an Advanced Class license due to the uplink frequencies; however, the lower 15 kHz of the transponder uplink are in the Extra band.

After the failure to effect contacts from the fishing site, attempts were made employing the home system. Using a 25-year-old HF transceiver for the uplink and a 15-year-old HF transceiver on the downlink in conjunction with dipoles in the attic, several contacts were easily made during the first 15-minute pass. The increased number of users on RS-12 heightened contention for the limited space in the 40-kHz-wide transponder. The typical RS-12 operator was using more power, single transceivers and sometimes a beam, or at least a good outdoor antenna. This was verified by a survey over the air and from QSL cards.

Many of today's amateur HF transceivers can operate crossband, i.e. they can be used to monitor one band (like 10 meters) and transmit on another (15 meters for example). While they cannot operate full duplex (simultaneous receive and transmit), a few calculations and some practice provide prospective RS-12 users with methods for satellite operation. RS-12 operators have discovered that Doppler shift is minimal on HF. When transmitting on 21.240 MHz, the downlink will be within a kHz of 29.440 MHz. Since the transponder is linear, the same correlation holds true throughout the 40 kHz passband. Many hams have avoided RS-12 activity due to the problems encountered with a 15 meter transmitter in close proximity with a 10 meter receiver. Those with only one HF rig don't even know about the problem, they just make contacts. After chasing digital satellites and high-orbit, high-tech hamsats, RS-12 is a refreshing change—back to basics.

Check *The RS Satellite Operating Guide* by G. Gould Smith WA4SXM for more information about the RS-series hamsats. The booklet is available from AMSAT at (301) 589-6062, or you can write to them at 850 Sligo Avenue, Suite 600, Silver Spring MD 20910.

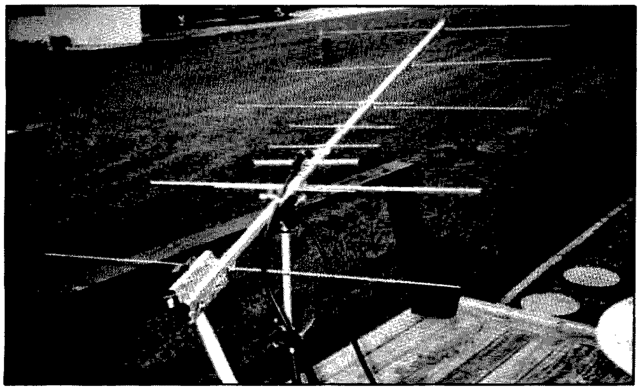


Photo B. A Cushcraft A270-10S dual-band yagi on a camera tripod did a great job for some A-O-13 Mode B contacts.

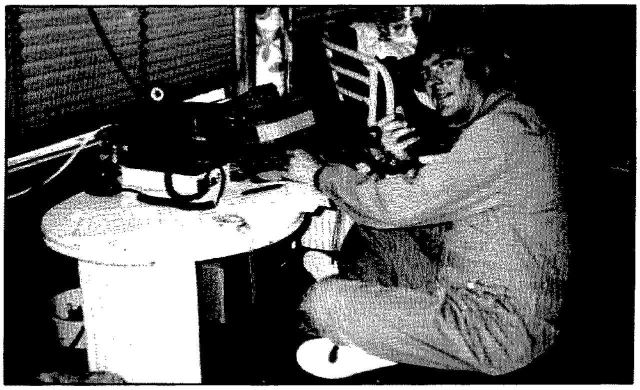


Photo C. Andy WA5ZIB at the controls during an A-O-13 pass. (Photo by Stuart Ross.)

RTTY LOOP

Number 12 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
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Baltimore, Maryland 21208

How RTTY Works

I am constantly reminded by your correspondence that many "RTTY Loop" readers have not been in digital communication these past few decades. Even some of you old-timers (whose original ham tickets pre-date my birth certificate) are just now barely getting started in RTTY, packet, or the like. Thus, I often find more basic questions mingled in with letters about this or that program, computer, or piece of equipment; such as "Just how is RTTY transmitted, anyway?" This month's column is addressed to that segment of the readership. To those of you who already know all this, you are excused. For those who want a quick refresher, jump to the end of the article. The rest of you, here we go.

Unlike CW, where the various letters of the alphabet, figures, punctuation, and special functions are represented by groups of long and short signals ranging in length from one unit (the letter E) to 20 or more, the various forms of radioteletype each use a unique vocabulary of alphabets. While none of these alphabet sets is exactly the same, they each share one characteristic. Within each set, each character is precisely the same number of bits as any other.

The two most common alphabet sets used are the five-level code commonly called "Baudot" (but more properly called "Murray"), and the seven-level code commonly called ASCII, which is also represented as an eight-level scheme in some circles.

Having established that, the next problem is how to send these codes along a radio circuit. The most direct means would be to key a CW transmitter directly with the TTY pulses. The result is often called "ON-OFF" keyed RTTY. ON-OFF keying was, in fact, the earliest method used to transmit TTY over the air. Advantages are related to simplicity in transmitting: merely hooking the teleprinter to the key jack. Receiving is also easy, with simple demodulation of a single tone. Disadvantages relate primarily to interference susceptibility and fading. A nearby CW signal can wipe out an ON-OFF RTTY station, and fading can remove letters or words.

A better way to send RTTY is by presenting a constant signal for the MARK, or resting, state and changing it in some way for the SPACE, or signaling, state. Changes may be introduced in amplitude, frequency, or by a superimposed modulating waveform. Direct amplitude modulation with the RTTY signal approximates ON-OFF keying, with all of its attendant flaws. Some fancy forms of modulation will be discussed at the end of this column, but the two most-used ham techniques are FSK and AFSK.

FSK

In FSK or frequency shift keying, a carrier is shifted in frequency to correspond to the MARK and SPACE frequencies. Figure 1 (b) diagrams this nicely. Like those that follow, this is a redundant system. That is, information is obtainable by looking at either MARK or SPACE, even in the absence of the other one. Remember that in ON-OFF keying, if you lose the SPACE you have a steady MARK, and if you lose the MARK you have nothing! Transmission of FSK is accomplished by shifting the transmitter VFO in step with the RTTY signal, and reception by decoding either or both the MARK and SPACE. Done properly, this system is very immune to interference and, since fading normally affects only one of the MARK or SPACE frequencies at a time, proper use of the built-in redundancy makes fading no problem, either. The frequency shift involved may be anything from kilohertz to fractions of a hertz, which might be more properly called "phase shift." In amateur circles, the standard shift these days is 170 Hz, while for many years, a shift of 850 Hz reigned supreme.

AFSK

Unfortunately, FSK presumes very stable transmitters and receivers. The level of shift is less than 1 kHz, and drift in the VFO of any significant degree would be intolerable. Early VHF transmitters could not maintain this degree of stability. Use of an audio tone, shifted in frequency in a manner similar to FSK, became the standard on VHF. Take a look at Figure 1 (c). This AFSK is quite useful in its own right, and note that the MARK, which is the lower frequency in standard FSK, becomes the higher frequency in standard AFSK.

Now, some fancy stuff. What if I send a pulse during each 22 ms window which represents a bit at 45.45 baud Baudot speed? By changing the pulse's amplitude or position within the window, I could encode MARK and SPACE with a decodable system. Figure 1 (d) shows what I mean. Such Pulse Amplitude Modulation (PAM) or Pulse Position Modulation (PPM) is not used much in the amateur service, but it is neat, right?

Overall, these techniques remain the standards, whether at that fabled 45.45 baud Baudot, or even at super-speed packet. With experience, one can even begin to appreciate the subtleties which make a RY sound different from a CQ. When you begin to copy straight text by ear, though, tell me about it!

As always, I look forward to your comments, questions, and comments. On Delphi (username MARCWA3AJR), you will find the "RTTY Loop" index and at least the first in the series of "RTTY Loop" software collections in the Radio SIG's data library. I often check in there as well, so feel free to leave me messages there. Email can be sent on Delphi, as well as CompuServe (ppn 75036,2501), America Online (MarcWA3AJR), or via Internet (MarcWA3AJR@aol.com).

QRP

Number 13 on your Feedback card

Low Power Operation

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Massillon OH 44646

There seem to be a lot of people who feel the same way I do about the Ten-Tec Argosy. The amount of mail I received on the series about the Argosy tells me that we should take one more look at this surprising little rig.

The Argosy Revisited

First, I would like to thank all those who have sent me copies of the *Ham Radio* article I mentioned earlier. That article was written by Cornell Drentea WB3JZO, and appeared in the November 1986 issue of *Ham Radio*. The article, "Upgrading the Ten-Tec Argosy," is must reading if you own one of the first Argosys built by Ten-Tec. Also, the January Issue of the *QRP Quarterly* has an excellent article by WB3JZO with updates from his *Ham Radio* piece.

Linear Amplifier Switching

Although the Argosy can produce only 50 watts of RF output, you can use this rig with an external amplifier; provided you have some means of controlling the T/R function of the amplifier. Ten-Tec used a small T/R module installed inside the rig. That module, model 1126, is no longer available but that's not a problem because you can roll your own with just a handful of parts. A small piece of perfboard would be ideal for this project. Figure 1 shows the complete T/R switch for an external amplifier.

Its operation is very simple. When the "T" voltage goes +12 during transmit, it charges the 33 mF capacitor. This turns on the switching transistor and pulls in the relay. The capacitor is discharged through the delay control. Any time the Argosy goes Into transmit the relay will close. The contacts from the relay are routed to the "spare" phono jack on the rear apron.

The circuit board mounts on the side panel in the left rear corner. There are two mounting holes for the original board; they will work just fine for our home-brew circuit as well. The cable plug is there, too. The colors are violet, red, and yellow. This plug is hidden by the wire harness. Using an 0.100 center header, you can just plug it in. Of course, you have to wire your header correctly to mate with the rest of the circuit. This is the type of circuit I like. it's simple and oh so easy to get working.

Improved RF Gain Control

While neither the Argosy nor the Argosy II came with an RF gain control, you can add your own. Ten-Tec's technical note TN2-525 is the official version of an RF gain control. If you use the values in the technical note, you'll end up with an RF gain control that functions over only 40 percent of its range. The solution is to insert a 10k resistor from the other end of the pot to ground. This expands the tuning range of the RF gain pot. The MC1350 IF amplifier is controlled by a very narrow voltage range in the rig. This "RF Gain" voltage is only 1.5 volts, the difference from 5.0 to 6.5 VDC applied to the MC1350. The new RF gain control should provide 5 to 6.5 volts to the junction of D9, D10 on the IF/AF board. Again, this modification is only for the Argosy. I don't know of any for the Argosy II, but I'm sure they're out there. Readers?

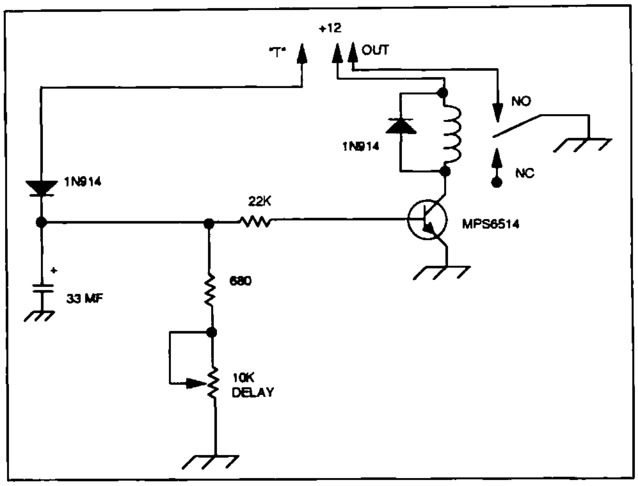

Figure 1. Amplifier T/R switching for the Argosy.

"If you're really into contests, or weak signal CW work, then you might want to check out this modification."

Selectable AGC Time Constants

Personally, I think the AGC works just fine in my Argosy II. But if you're really into contests, or weak signal CW work, then you might want to check out this modification.

By far, the easiest method of installing an AGC switch into the Argosy is to unsolder D9 from R26 on the IF/AF board (80785). A better method is to bring one side of R58 to a switch, with the other side of the switch grounded as shown in Figure 2. If you use a three-position switch, you'll end up with three AGC time constants: slow, fast and AGC off. Use a high quality capacitor for the AGC circuit. Tantalum or low leakage electrolytic capacitors are the best ones to use. The values shown provide a good comprise between CW and SSB time constants.

There's no place on the front of the Argosy to install such a switch. It's going to be a challenge to find a place for

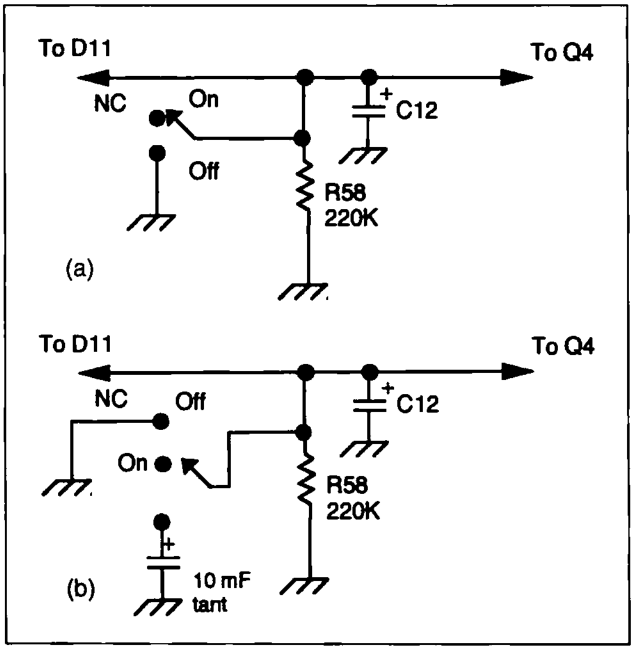

Figure 2. a) Simple AGC for the Argosy. b) ACG with fast/slow time constants.

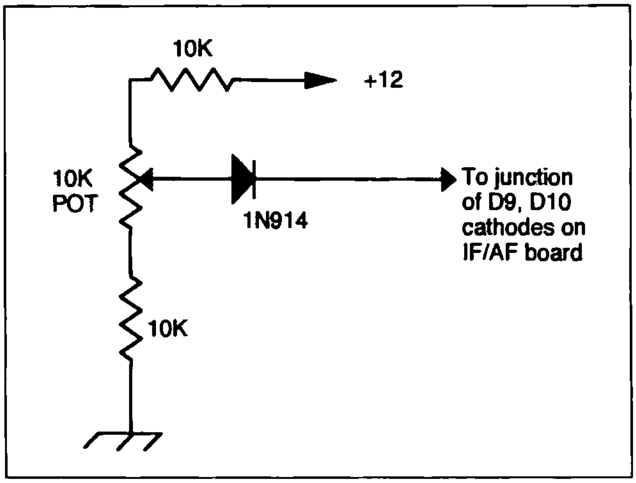

Figure 3. Improved RF gain control for the Argosy.

it—even the rear apron is getting kinda busy. A small toggle switch might fit if you do some forward thinking before you start drilling.

If you have not installed the RF gain control you can pass on turning off the AGC. But by wiring the noise blanker on all the time you can use the blanker's switch to select between two time constants. Again, you don't want to turn off the AGC unless you have installed the RF gain control.

Improved Noise Floor

This modification came from Cornell Drentea in his *Ham Radio* article. It's so simple I had to include it in this column.

The original Argosy has a very high noise floor. It's enough to make weak signals impossible to hear. The noise came from the BFO sidebands spilling over to the high gain audio amplifier. This "hiss" obscured signals below S3. The fix is simple: Change C34 from 0.01 to 0.1. This change will reduce the hiss to a point you'll easily hear without test equipment! Capacitor C34 is located on the IF/AF board.

Reduced Hum Pickup

This has always been a problem with Ten-Tec rigs. The power switch runs 110 AC through the main chassis. High gain stages can pick up any stray AC and pass it from one stage to the other. There are two fixes. Run the rig from a battery supply. Or, you can disconnect the AC control line from the power supply (internally, so the power switch inside the rig is dead) and use the main power switch on the supply to turn the rig on and off.

You might want to try shielding the power line inside the Argosy with aluminum foil. Copper mesh screen would be ideal, but that stuff is almost impossible to find anymore. Be sure you ground the shielding in several places to avoid ground loops.

"Before you start digging inside your Argosy, be sure you know what you're doing!"

Internal Keyer

If you don't have the T/R control board inside your Argosy you can use that space to install your favorite electronic keyer. All you need to do is add the proper three-wire jack for the key paddles, and of course the keyer speed control. The popular Curtis keyer on a chip would be ideal. Several PC boards have been designed using this chip. Check available QRP books for suggested Curtis keyer PC boards.

Several of the modifications for the Argosy require the use of a dual concentric pot. Mouser electronics carries some of the more common values. Digi-Key also carries some dual pots. The only problem is finding a set of matching knobs. You can use a set of knobs from Ten-Tec. They used dual controls on both the Corsair and the Argonaut II, but they won't match the ones used on the Argosy. Since Ten-Tec makes their own knobs, along with other stamped out pieces parts, you'll never find an exact match that fits.

Standby Current

A higher-than-normal receive current may be traced to an improperly adjusted final PA bias. Although it's an adjustment that should not be touched, it's relatively painless to reset. All you need is an ammeter in series with the VCC line to the PA. Adjust trimmer R1 on the PA board until the current is 30 mA. The trimmer is kinda hard to reach, so measure the receive current first before you attempt this adjustment. More than likely, you'll find the receive current to be within specifications. If not, look at the bias adjustment.

A Word of Caution

Before you start digging inside your Argosy, be sure you know what you're doing! Some of the modifications presented here and in the *Ham Radio* article require the complete teardown of the rig. If you don't feel secure about such projects, then it's best to pass them by. If you want to try some of these modifications, install only one at a time. Test the rig for proper operation before you start on the second modification. Test again and then move on until you're done modifying the rig. I can't say if all the modifications presented here work—I haven't done too many of them on my Argosy II.

Better-Sounding Argonaut II Audio

I found that you can really make the Argonaut II sound much better just by using an external speaker. The one inside the rig is way too tinny-sounding for me. I use a Minus speaker from Radio Shack. The black metal one is just about the right height and style to match the Argonaut II. It's too bad Ten-Tec did not offer an external speaker for the Argonaut II/ Delta II.

Number 14 on your Feedback card

Carr's Corner

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Using the "Spectra Plus" Spectrum Analyzer Software

A spectrum analyzer is a device that will permit you to look at a signal in terms of amplitude vs. frequency, rather than the normal oscilloscope amplitude vs. time presentation. All signals can be depicted as a fundamental sine wave, plus a number of additive sine and cosine harmonics. The particular shape of any given signal is set by the particular harmonics and phases present. It is possible to analyze the general spectrum by looking at the waveform, but for particular and accurate information you need to use a spectrum analyzer.

Professional spectrum analyzer instruments are costly, and beyond the financial capabilities of most amateur radio operators. Some people have been successful in building their own spectrum analyzers, but even these instruments get pricey when capability goes up (especially frequency resolution and accuracy of the frequency display).

Now you can use IBM-compatible computers to do audio spectrum analysis of signals, including signals received off the air . . . if you have a sound board compatible with at least the 8-bit SoundBlaster board. The sound board serves as an analog-to-digital converter to translate the analog audio signal into a series of digital data that can be digested by the computer.

The spectrum analysis software is "Spectra Plus Ver. 2.0" by Pioneer Hill Software, 24460 Mason Road, Poulsbo WA 98370; (206) 697-3472. Hardware requirements are rather modest by today's standards: a 386 or later IBM-compatible machine with 2 Mbyte of memory minimum, or 4 Mbytes for recording; a VGA monitor capable of at least 16 colors (which is about all of them, except for monochrome), 1 Mbyte (plus space for audio files, which can be large) hard disk space available; Windows software; a sound card (16-bit recommended, but 8-bit will work); and a mouse or trackball.

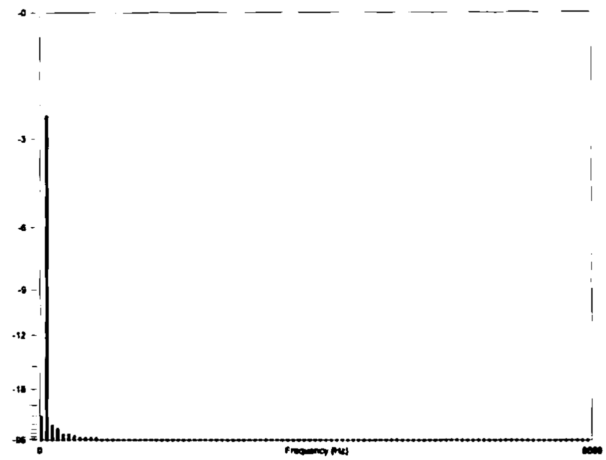

Figure 1. 100 Hz sine wave.

There are three modes and four functions: Real-Time, Recorder and Post-Processing. The Real-Time mode accepts digitized audio directly from the sound card, and then analyzes the waveform and displays the results. Although the program can be run indefinitely, the raw audio data cannot be saved in a disk file.

The Recorder mode digitizes the input audio signal, and stores it on the hard drive in a .WAV file (the standard audio file format). These files can later be analyzed in the Post-Processing mode or played back through an audio system. My wife is a musical composition student; she can use the SoundBlaster card in our computer to digitize sounds and use them as a synthesizer. The "Spectra Plus" can control the process, as well as analyze the spectra of the waveform.

The Post-Processing mode processes recorded audio data, whether from the record mode above or from other sources. It looks for a .WAV file. More of the functions of the software work with this mode than with Recorder or Real-Time.

The functions of "Spectra Plus" include Time Series, Spectrum, Spectrogram, and 3-D Surface Plot. The time series is the ordinary amplitude vs. time display that one sees on an oscilloscope. In this mode, the digitized audio is seen in the Volts/Time display on the computer screen, and it can be printed.

The Spectrum function analyzes the audio signal, and then produces an amplitude (volts) vs. frequency display (examples given below).

The Spectrogram produces a display that has frequency spectrum along the vertical axis, and time along the horizontal axis. This type of display is useful for seeing the time history of the spectrum, i.e. how the frequency content of a waveform changes over time. This mode can be used for analysis of "Whistlers," i.e. those low frequency ELF radio signals emitted by distant lightning strikes. Note well, however, that this mode works well on the screen, and prints well on a color printer, but its printout on my Laserjet III is pukey.

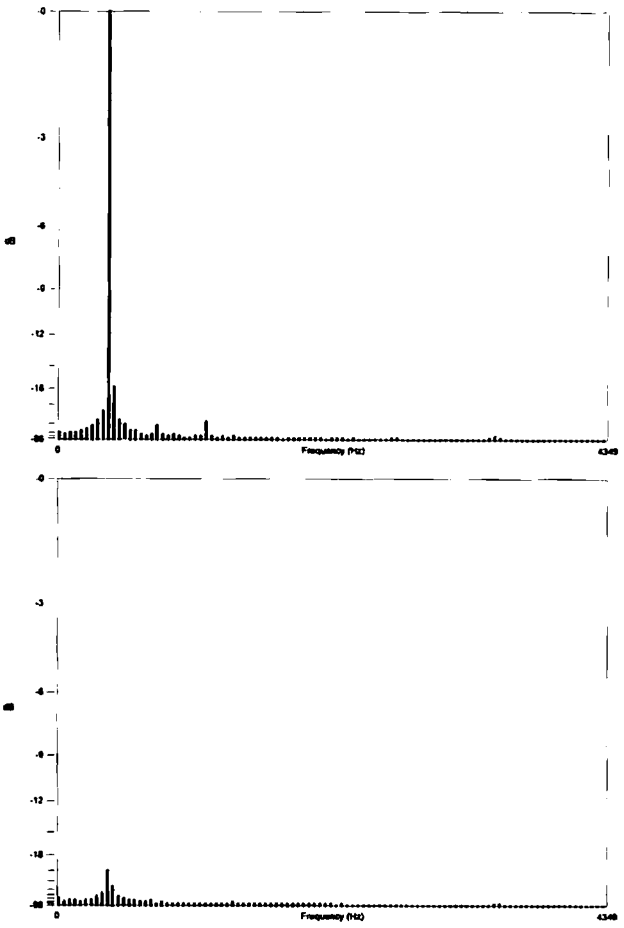

Figure 2. A) CW station emitting dashes. B) Apparently, a CW backwave as it appeared between transmissions.

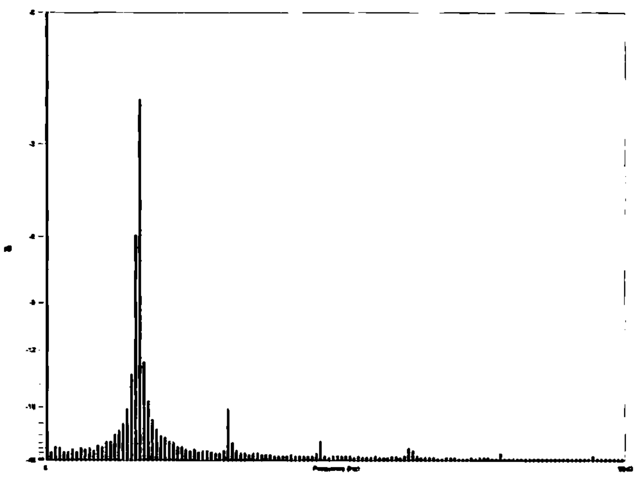

Figure 3. AM signal modulated with 1000 Hz.

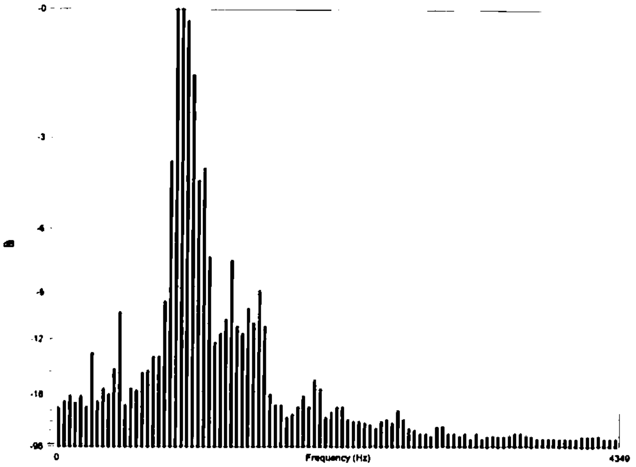

Figure 4. 40m SSB motor-mouth signal.

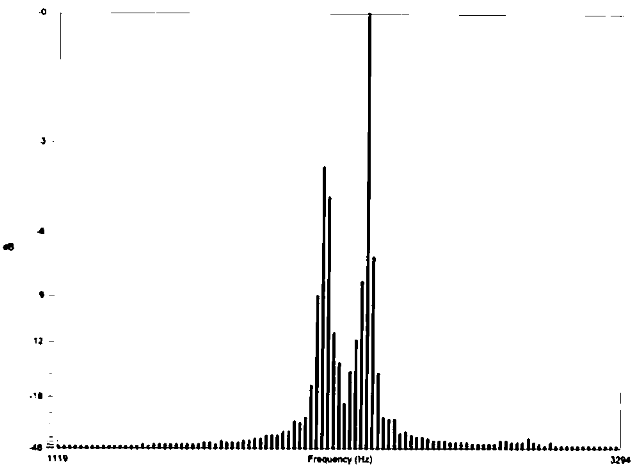

Figure 5. RTTY signal with 200 Hz spacing.

The 3-D surface plot displays a three-dimensional perspective of the spectrum over time. It appears to contain amplitude information, frequency information and time information.

"Spectra Plus" Display Examples

Figure 1 shows a spectrum of a sine wave from a signal generator. Note the single frequency spike (which you would expect from a pure sine wave), plus some noise along the baseline. This sample was a 100 Hz sine wave digitized in 16-bit mode at a rate of 44 kHz using my SoundBlaster Pro-16 sound card. The signal source was my bench function generator. Note that the amplitude scale along the vertical axis is normalized to make the large spike 0 dB, and all other features as negative dB. The frequency calibration along the horizontal axis is printed out to nearly 8,700 Hz, and shows no additional harmonics.

Figure 2A shows a CW station transmitting a series of dashes. This signal was recorded off the air using a communications receiver with an 2.7 kHz SSB filter. Note that the main signal is a large spike (as expected, with a series of sidelobes along the baseline, plus what appear to be harmonics. Note that the signal does not have zero bandwidth, which explains why a filter with 100 or 250 Hz (or so) is used for CW. Figure 2B shows the same station a few moments later with the carrier turned off. It appears that it is emitting a rather serious backwave, i.e. a signal that passes through the final amplifier even when the rig is ostensibly not transmitting. That would be good info to know if my interpretation of the waveform is correct.

The display shown in Figure 3 is an AM signal from my signal generator. The sig-gen was tuned to an AM BCB frequency, and was modulated with its internal 1,000 Hz sine wave oscillator (which is a tad distorted). Note that the sidebands extend out quite a distance. I suspect the distance the sidebands extend from the carrier is a result of the clipped positive peak I've noted on the modulated signal, and also on the raw modulating 1,000 Hz sine wave.

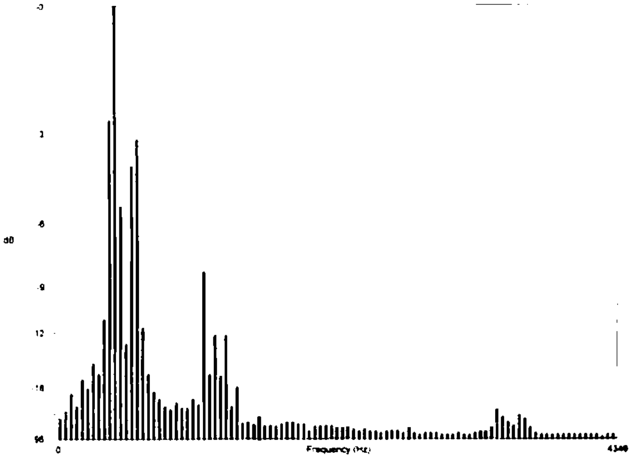

Figure 6. AMTOR signal.

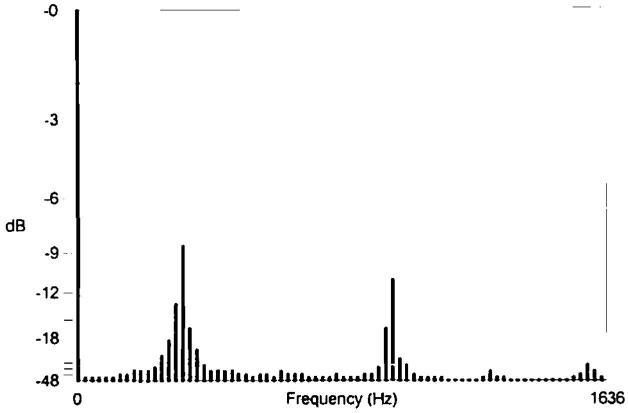

Figure 7. Space telemetry signal.

Figure 4 is a signal I wish I hadn't heard. It's a 40m SSB signal, along with other stuff that was interfering with the signal. The reason why I wish I hadn't heard it is that the source was one of those jerks who argue with everybody, are mean-spirited, and use foul language that was once illegal on the air. The QSO was a real food fight amongst adult juveniles who need to be gotten off the air.

Figure 5 is from a sample .WAV file supplied with the software. It is of a radioteletype (RTTY) signal with 200 Hz mark-space separation. Note the two-spiked appearance of the waveform, and that both spikes have their own sidelobes.

Figure 6 is the spectrum of an AMTOR signal that I recorded off the 20m band, while Figure 7 is a space telemetry signal that is among the "Spectra Plus" samples.

The "Spectra Plus Ver. 2.00" software is a useful adjunct to ham radio operations for those who have a Windows-compatible computer. It's also a useful thing for shortwave listeners to have available as it will, with a little experience, help them identify some of the non-voice, non-CW signals that are frequently heard on the air.

Low-Noise Preamplifiers

A lot of readers responded to my offer of the MAR-1 RF preamplifier kit. The MAR-1 kit is spec'd from near-DC to 1,000 MHz, with gain of 15 to 18 dB, 50 ohm input and output impedances, and a noise factor of 5 dB. That kit sells for $10 postpaid. I now have the same printed circuit board, plus a MAR-6 device and two chip capacitors for $14.95. The MAR-6 is spec'd at near-DC to 2,000 MHz, gains from 11 to 20 dB (depending on frequency), and a noise figure of 2.8. Anyone wanting one of these kits can contact me at P.O. Box 1099, Falls Church VA 22041. 73

Mini-Joystick Scanning

Shift your tuning into high gear!

by Shane P. Brady WB2WPM

Contesting has become very predominant in the WB2WPM shack in the past few years. While never going for the win, I usually try to spend at least 12 to 15 hours on a major contest. My modest station is composed of a Kenwood TS-440 interfaced with my PC.

There are two predominant programs I use during contests: KE1A's CT, and N3EQF's LOG-EQF. Both of these admirable programs now support the Kenwood radios—finally! While this allowed me to jump bands and have the programs follow along, giving me exact frequencies on my logs, I still had to manually tune the radio. Not having stacked monobanders on each band and a kW output, I had to rely on the search-and-pounce mode of operation. Trying to control a frequency with 100 watts and the ever-sought-after rare "WB2" prefix is difficult, to say the least, in most circumstances.

At the end of the contests I found myself with severe "contester's elbow." This dreaded ailment is caused by entering calls on the keyboard, then reaching up and tuning the radio for a new station. As I would reach up for the tuning knob my elbow would hit the operating table. While not a problem for day-to-day activities, over a contest's duration this may result in hundreds upon hundreds of impacts. I have operated with an elbow pad which has helped a little.

The Joystick

What I needed was a method of tuning that would not require my hands to ever leave the keyboard. From my Commodore days I remembered a small self-stick mini-joystick designed for use with the GEOS programs. Made by Suncom, this lcontroller design is small and is made to mount directly to a keyboard. With one of these mounted on my keyboard I should be able to tune up and down without reaching for the radio.

Looking at the Kenwood manual, the mike connector has output for up-and-down tuning, and of course keying the transmitter. I located a source (Tenex Computer Express, P.O. Box 6578, South Bend IN 46660-6578; 1-800-786-6781; $17.95 plus S&H) for the joystick and ordered one.

Having seen them before, I knew it came with a small coiled cord that would not be long enough to reach the rig; I was going to need an extension cord. The joystick comes with the same 9-pin connector used by all those long-forgotten Atri joysticks. While waiting for my purchase to arrive I bought an original Atri joystick for 25 cents at a hamfest. If you are unable to find an old joystick to scavenge the cord and connector from, Radio Shack sells them.

The Connections

After I received the new joystick, the next step was to determine which wires went to what joystick action. I cut the old Atri control stick off and discarded it. With the remaining wire I stripped back the insulation and plugged my extension cord into the new mini-joystick. From the *Commodore Users' Guide* I located the pinouts for the connector; pin 8 is ground. Using an ohmmeter made it quick to determine the other wires needed. The joystick was going to be mounted upside down from its intended use. Keeping this in mind, on my particular cable the wire colors were as follows in relationship to joystick movement:

Ground	Black
Right	Green
Left	Brown
Up	Blue
Down	White
Fire	Orange

In the shack I use a boom mike and foot

Continued on page 67

Photo A. WB2WPM's joystick-controlled contesting station.

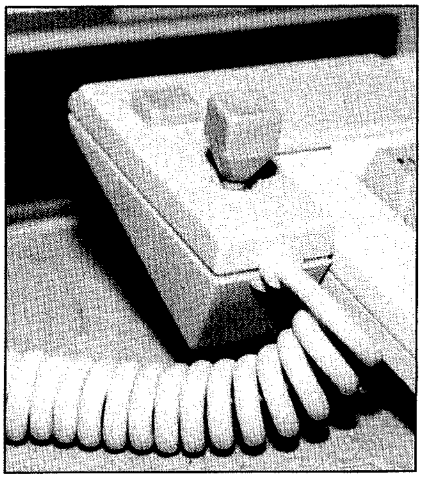

Photo B. Close-up of the joystick, mounted to the keyboard.

Number 16 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
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Staten Island NY 10313-0006

Instructor's Workshop

Sadly, this was the first time in eight years that I was forced to miss going to the Dayton Hamvention. Two weeks prior to the weekend that I look forward to all year, I found out that I had to undergo back surgery to alleviate the excruciating pain of a herniated disc and a sciatic nerve problem. After months of preparation for the two forums that I do at Dayton each year, I was devastated. Of course, it's at times like this that you learn how wonderful it is to be able to rely on good friends to come to the rescue.

Bill Pasternak WA6ITF is an editor of *Westlink Report*, and has been a dear friend of mine for many years. He immediately sprang into action, along with forums director Ron Moorefield W8ILC, to take care of my forums and to make me feel as though I were still participating in the weekend. No small task, but they pulled it off!

The very talented Bob Grove WA4PYQ, publisher of *Monitoring Times*, agreed to co-moderate the Instructor's Workshop with Bill. With these two very capable men running the forum and with the excellent speakers I had lined up, I knew it had to be a big success.

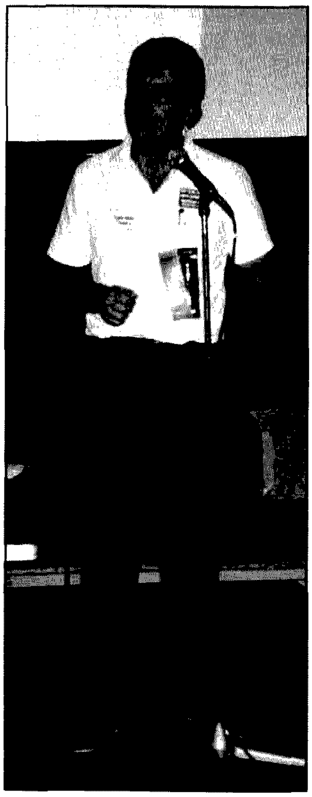

Photo A. Bob Grove WA4PYQ, co-moderator of the Instructor's Forum.

Bill had dispatched Henry Feinberg K2SSQ from AT&T to my home a few days before my surgery in order to videotape my introduction to my forums. On Friday, April 29, the Instructor's Workshop opened with a taped greeting from me. Since the entire event was being videotaped to send to me by Joe Eisenberg WAØWRI, I can't tell you what a thrill it was for me to watch this later at home. This forum is an important one to me because the audience consists of very special people. These are the folks who are using amateur radio in the classroom, teaching radio license courses, or who come to hear new ideas for recruiting people. It's the group that helps to keep amateur radio growing.

Bob Grove spoke first. He announced that he'd be publishing a new magazine called *Satellite Times*. It will include all aspects of satellite information, including amateur radio, weather, TV communications, and lots more. Bob spoke about using shortwave in the classroom. This eloquent speaker had been a high school science teacher for 16 years and is well aware of the advantages of bringing scanners and other radios into the classroom. He pointed out that many hams first got exposed to radio by listening to radio demonstrations in school. He explained the differences between broadcast and utilities and defined how they can both enhance and enrich classroom activities.

In foreign language studies, students can hear the actual language being spoken. A social studies lesson can come to life as the class listens to cultural programs on the radio which project an image of a specific country to the rest of the world. These programs describe the history, government, present state, arts, music and news from various countries in the world. Bob described how interesting it can be to listen to programs like the BBC which announces news as it is breaking. He referred to Radio Moscow and made note that propaganda can be fascinating to listen to in a classroom setting.

Using VHF/UHF scanners with kids helps them learn about what is going on around them. Listening to police calls, ambulance runs, and emergency teams of all kinds rendering medical assistance to victims can provide tremendous insight to students. Imagine the lessons that could have been taught with the use of a radio in a classroom during the L.A. earthquakes and the clean-up and rescues that followed.

Bob ended his excellent presentation by projecting that we're at a crossroads in communications and about to take an enormous leap skyward in the next few decades. A whole new world of satellite communications is about to open. Just think of the possibilities in a classroom!

My co-net control on the CQ All Schools Net, Gordon West WB6NOA, was next up to speak. Gordon's Radio School has been producing license materials and study guides for many years. Gordon is a good example of how an enthusiastic instructor is the key to the success of a radio program in a school setting. He stressed the importance of handing out lots of "stuff" for the kids to touch and look at. Having the class identify a bag filled with various electronics components is a good idea.

Gordon ended with his famous "glowing pickle" demonstration. Even though he cautioned that safety is always the first consideration, I could see on the videotape that the entire first row cleared out as he plugged into 110V to start the current going through the soon-to-be-exploding pickle. Be sure to join Gordon and the rest of our nationwide school net this fall for more good ideas to use in the classroom. We'll start out on 28.303 MHz at 12:30 EST on Tuesdays and Thursdays. If nothing is heard, we'll QSY to 21.303 MHz.

My other net control on the school net is Jim Wilmerding N4MDC who discussed SAREX in the classroom. Jim gets a special thank you from me for converting the tapes of both my forums to VHS format. His presentation was superb, as usual. As a school administrator himself, he addressed the popular topic of how to talk to administrators when you want to get a school radio program started. He wisely stressed the importance of going in prepared, making an exciting presentation, and telling the principal what the children and the school will gain from the radio class.

As hams and as educators we all know the value of ham radio in the classroom, but be sure that the school administrator knows how it will enhance the existing school curricula. He also described his experience with the SAREX program at his school. Jim emphasized the importance of being flexible and having patience when you get involved with making space shuttle contacts. Of course, those of us who have done it all agree it's worth the effort. Jim will be assuming a new administrative position in Rockland, Maine, this fall. You'll be hearing more about him and his good works with radio and education in my columns.

Vicki Gigante KA3PVS is in charge of shuttle retransmissions at the Goddard Space Flight Center. Vicki made the point that today we only see the shuttle on TV when there's a problem or perhaps when there is a spacewalk taking place. She goes into schools to give kids the opportunity of sharing in the excitement of the space program via amateur radio. The amateur radio club at Goddard gives out scanners to schools so they can put it on the PA system for a launch or landing.

She accomplishes two things by

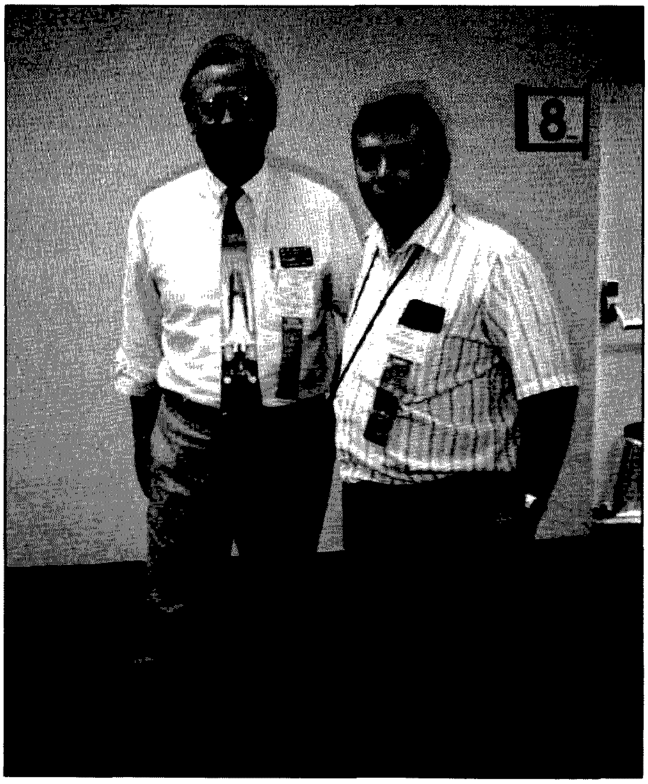

Photo B. Jim Wilmerding N4MDC (left) and Bill Pasternak WA6ITF (right).

going into different schools. First, she gets to demonstrate amateur radio to the children. Astronaut Ron Parise WA4SIR is a member of the Goddard ARC. He sometimes joins Vicki in the demo part of her visit and speaks with the students on the radio. Second, she is exposing kids to some of the more fascinating aspects of space travel and communications. The frequencies for retransmission are 3860 kHz, 7185, 14295, 21395, 28650 and on 2 meters 147.45 in the local area.

Bill WA6ITF described how he conceived of the idea of the Young Ham of The Year Award in 1986 for children under the age of 18. Burt Hicks, publisher of the *Westlink Report*, and Chip Margelli from Yaesu both support the effort and co-sponsor the award every year. Bill stressed that the qualifications they're looking for have nothing to do with how young a child is when he or she got licensed. They're interested in children who use amateur radio to make a contribution to the hobby, to the community, or to their school.

In 1990, the young lady who won the award was Mary Alestra KB2IGG, a 12-year-old from my ham radio program. Mary is everything we'd like a ham radio operator to be. I was so excited when she won the award! At Dayton, Bill showed the video of Mary accepting the award four years ago, highlighting her incredible speech. Be sure to nominate a deserving youngster, if you know one, for 1995.

Bill then introduced Cathy Gilliland KBØFDU, age 16, who is the narrator of a new video, "This Is Amateur Radio," being produced for young teens. Cathy takes you on an on-screen guide to amateur radio, as seen through the eyes of a teen-ager. Bill hopes to distribute the video to public schools across the country.

Cynthia Wall KB7ITT was the last speaker at the forum. She is the author of a series of adventure books seen through the eyes of youngsters. The Great Northwest is featured in her books, along with amateur radio. These books make a wonderful addition to any classroom, or to any child's collection.

Cynthia is very concerned about making children aware of safety in the wilderness. She goes into schools and talks about the difference that possession of a radio would make during disasters such as the Mt. Hood incident. The books are all problem-solving books which teach kids how to think for themselves. The heroes solve their own problems. We can look forward to a new book coming out in August about the great whales.

I'll always be grateful to Bill and Bob for doing such a professional job with the Instructor's forum. Anyone who missed it this year realty missed some exceptional presentations. I hope we can all meet there next year at Dayton.

Mini-Joystick Scanning

Continued from page 65

switch. On the Kenwood mike connector I only had the audio going into the connector. This left lots of room to route my new cable into the connector. I wanted to be able to disconnect the joystick from the radio without disconnecting my boom mike, so I wired a 5-pin DIN plug right at the connector.

There were only three functions I needed to connect up to the radio: scan up, scan down, and the PTT. (After all, why let that "fire" button on the joystick go to waste?) In wiring the connector, I decided that the up and right (blue and green) would be the joystick motion for scanning up. These both went to pin 4 of the mike connector. The down and left action (white and brown) would control the scan down function; these were soldiered to pin 3 of the mike connector. The last two connections were the ground (black) going to pin 8, and the fire/PTT being connected to pin 2.

After double-checking all wiring with an ohmmeter to assure myself I had the proper orientation of joystick movement, it was time to test it out. As you can see from Photo B, I have actually mounted the joystick upside down on the upper-left side of the keyboard. There is just enough room on my board to position the joystick with its self-stick backing.

Results

Everything worked out better than expected. On the TS-440 the scan rate is a bit on the slow side, just right for contesting! I have found that I have good control over tuning with just a little pressure from my little finger on the stick. And, if I'm so inclined to, I can use the fire button to key up the transmitter.

The last contest went off flawlessly, and I didn't succumb to the dreaded contester's elbow. This has worked out so well, I might pick up some more of these joysticks, just to have on hand for projects down the road. After all, it is a strain to reach up for that rotor control . . . !

Number 17 on your Feedback card

PACKET & COMPUTERS

Digital Amateur Radio

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SMTP—The Right Way to do Mail

For the past several months this column has focused on TCP/IP in general and JNOS in particular. For those just tuning in, TCP/IP means Transport Control Protocol/internet Protocol. That mouthful is a suite of applications that handle communications for the Internet—you know, the "Information Superhighway." [As an aside, there is no such thing as the "Information Superhighway." The term is a political invention, and it makes me slightly ill just to hear people talk about it. It's more like a few interstates, some county roads, and a whole lot of side streets and driveways. This is not to imply that the Internet is without value; it is very valuable. The idea of the Information Superhighway is just political nonsense—the reality is much more complex. Well, enough editorial, let's get back to the real world.]

The Internet was developed by ARPA (Advanced Projects Research Agency—now DARPA, with the D for defense), in cooperation with academe and industry, as a way to promote cooperation in research and on government projects. The Internet project was not just the construction of the physical network to carry the signals, but also the development of the TCP/IP protocol suite. To simplify what is going on there: The TCP portion takes care of moving the data around; the IP portion takes care of packaging the data so it is useful and understood.

SMTP (Simple Mail Transfer Protocol) is the way the electronic mail is sent in the IP world. It is really a simple protocol; in fact, it uses English to send commands back and forth. You can actually send mail as if you were an SMTP server by using telnet (the IP remote login program) to connect to port 25 (IP services are associated with ports, also called sockets: each port provides a different service), and issue a few commands:

```
:telnet host.com 25
Trying...
Connected to host.com.
Escape character is '^]'.
220 host.com — Server ESMTP
(PMDF V4.3-7 #6563)
help
214- Available
214-
214- DATA, EHLO, EXPN, HE-
LO, HELP, MAIL FROM
214- NOOP, QUIT, RCPT TO,
RSET, SAML FROM
214- SEND FROM, SOML FROM,
TICK, VERB, VRFY
214- XADR, XSTA
214
```

You can see here that I connected to a host and issued the "help" command. Notice the numbers that preceed each line: The text is for humans, and the numbers (220, 214) let automated SMTP servers understand the messages with ambiguity.

OK, so why is SMTP so good? Let's take a look at how it works if you let your system do the work. First, how does "normal" packet mail work? I want to send a message to my friend Mike AA9FP, so I take these steps:

1. I connect to my local PBBS. Depending upon your QTH, this may be easier said than done. As we have discussed before, the LANs (Local Area Networks) in the packet world are generally (mostly) completely unmanaged. Hidden transmitters are everywhere, causing interference and often making staying connected a hit or miss proposition.

I should also point out that my beautiful new 486 machine is now doing the work of a dumb terminal, and probably talking to one of the 386SX machines so often seen as PBBSs. Something is wrong when your $3,500 hot rod is doing the work of a wheelbarrow.

2. While fervently hoping that I will not be disconnected, or make a typo, or get a phone call, or (you get the idea), I type my message. Generally the text reflects my anxiety about the situation (i.e.: it ain't no masterpiece.)

3. I go have a cold drink, and hope that I never have a desire to talk to Mike again.

OK, OK, so I am being dramatic. The point is, the current system causes a huge quantity of unnecessary traffic. It wastes the power of the local computers—even if they are just XTs or 286s, and it is not much fun.

With SMTP the digital ham radio hobby is much more relaxing. Here's how that same message gets sent:

1. I login (locally on my own machine) to my own mailbox.

JNOS (the TCP/IP program we have talked about in this column) provides a full-fledged PBBS which can be used as a personal mailbox or a full-blown PBBS with mail forwarding of the traditional kind. The login process is easy:

```
Trying 127.0.0.1:telnet...
Telnet session 1 connected to
Local BBS
JNOS (n1ewo-9)
Welcome to N1EWO [44.48.70.22]
login: n1ewo
Password:
[JNOS-1.10o-IHM$]
You have 1 message - 0 new.
Area: n1ewo Current msg# 1.
?,A,B,C,CONV,D,E,F,H,I,IH,IP,J,K,L,
M,N,NR,O,P,PI,R,S,T,U,V,W,X,Z >
```

2. The steps from here are very much like being connected to a "normal" PBBS, just much more relaxing.

One thing that I notice right away is how quickly the machine reacts (I am connected to my own machine and *not* over the air). I also cannot be dumped because of interfering stations. Another difference is addressing. Instead of the normal sort of AA9FP@WJ9U.#CIN.IN, I type:

```
Area: n1ewo >
sp Mike
Subject:
Hello!
```

Enter message. End with /EX or ^Z in first column (^A aborts):

Notice that I called him "Mike." This is because I have a file of aliases that allow me to use names that I understand and remember easily—just a nice convenience. The real difference, though, comes when I finish.

The delivery of SMTP mail is the revolutionary aspect. With the current system, mail is collected by a centralized PBBS then delivered as packages to various distribution points. It finds its way through the system to the destination PBBS and waits for the recipient to connect and check it. (It has become more common for individuals to run similar packages and get their mail directly.)

With SMTP, delivery can go one of two ways. If the recipient is local, the SMTP server (on your machine) will connect directly to the SMTP server on his machine and make the transfer—no third parties involved. It will do this in the background while you do other things, and will keep trying 'til you stop it. It is fun to send your first SMTP mail message and watch the process.

The second possibility is that an SMTP gateway would be used. If the recipient is too far from you to talk directly, a machine locally can be used as a gateway, and the mail will be routed to the destination. This can occur in a batch like the current system or one at a time. A gateway today would very likely resort to the current packet network for the hop in between, and an SMTP gateway on the other end would do the delivery.

Notice that there is no requirement for the recipient to connect anywhere but his own mailbox. This system has a flaw, though. It requires that the recipient's machine be available at all times, ready to receive mail. Not all of us can do that.

POP Goes the Email

The answer to this problem is POP (Post Office Protocol). With POP there is a server in a local area which receives mail for a particular ham—like a PBBS does today. But, instead of connecting to the PBBS and reading the messages, POP is a background batch process. When I start up my station, it checks the POP server for mail and transfers any it finds. All automagically—pretty neat.

OK, fine, but how do I do this?

Well, the first step is to get a copy of NOS (Network Operating System) or a variant. We have been using JNOS—my favorite. It is written by Johann (WG7J) and has reached its final "official" release version 1.10c. Johann is working on a Windows version which should be spectacular. You can get the latest version on the Internet by anonymous FTP to:

```
ftp.ece.orst.edu
in the directory:
/pub/ham/wg7j
the file is:
110exe.zip
```

It should also be available on many ham-radio-related BBSs. You may find earlier versions—these will get you started, but 1.10c has several new features worth having. You may also see releases with later numbers. These are the result of the large following of JNOS users who continue to improve the source code and add features (and bugs, sometimes).

Reprints of this column's discussion of running JNOS are available—call the magazine. We'll discuss more about JNOS in future months. 73 de N1EWO.

HOMING IN

Number 18 on your Feedback card

Radio Direction Finding

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Testing the Ramsey SlyFox

I love building electronic gear. Long ago, I lost count of the number of kits I have put together. It's too bad that today's new hams cannot learn electronics by equipping their stations and test benches with ambitious kits by Heath, Eico, and Realistic. Most of today's kits seem to be the "jingling bag of parts" variety, consisting of just a small circuit board and components, without enclosure.

Simple kits are still a good, inexpensive way to learn about electronics and construction techniques. If you need an unusual product that doesn't have enough mass appeal to justify an offshore production line, a kit may provide the most economical way to buy it.

Ramsey Electronics (793 Canning Parkway, Victor NY 14564) provides many such "niche market" items. Last year, the company began touting a series of kits for fans of VHF radio direction finding (RDF). The long-promised Ramsey SlyFox 2 meter transmitter is now available to RDF contesters. (We call ourselves foxhunters or T-hunters, hence the name.)

It's Unique

The SlyFox (Model FHT-1, $129.95) is a complete 2 meter transmitter with a built-in microprocessor-based timer and CW identifier. Hook it to a DC power source and antenna, select the mode and timing, and it's ready to serve as a target for your club's next hidden transmitter hunt. An optional voice memory module (Model FHID-1, $29.95) is also available.

I have spent the last several weeks evaluating the SlyFox. I constructed a kit and got it working. I also tested a SlyFox that was built and tuned up at the factory. The manual for both was revision 1.2, dated October 1993.

"Homing In" has previously described and reviewed a number of timer/ID "foxboxes" that connect to your existing VHF-FM transmitter or transceiver to make it into a hidden T. Ramsey is the first and only company to offer a complete one-box transmitter-IDer kit. The idea is good, because most handhelds and mobile rigs are not intended for the continuous-duty full-power transmitting mode demanded by long-distance T-hunts.

On the other hand, the FHT-1 does not have a frequency synthesizer. Changing the hunt frequency means replacing a soldered-in crystal. There is no provision for bringing out audio and push-to-talk control to drive an external transmitter, say, for a hunt on the 50 or 222 MHz bands.

The SlyFox comes with a crystal for 146.52 MHz. That frequency is not commonly used for T-hunting anywhere, to my knowledge. Putting a three-hour T-hunt on the national simplex frequency would not be met favorably in most cities. A better choice would have been 146.565 or 146.43 MHz. Several areas of the USA use one or the other of these channels for T-hunts.

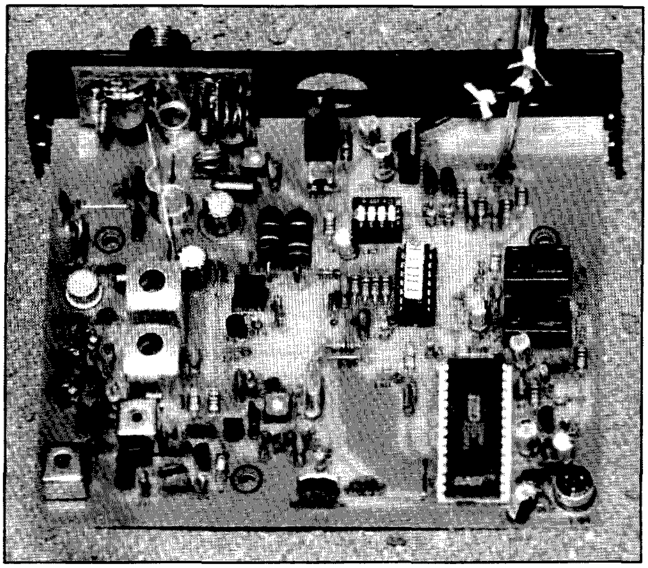

Photo A. The completed Ramsey FHT-1 SlyFox transmitter boards include the enclosure's end plate, which is mounted to the coax connector during assembly. Components for the optional FHID-1 voice ID kit are in the lower right corner of the main board. The three-conductor ribbon cable at upper right connects to paddles to program the CW IDer.

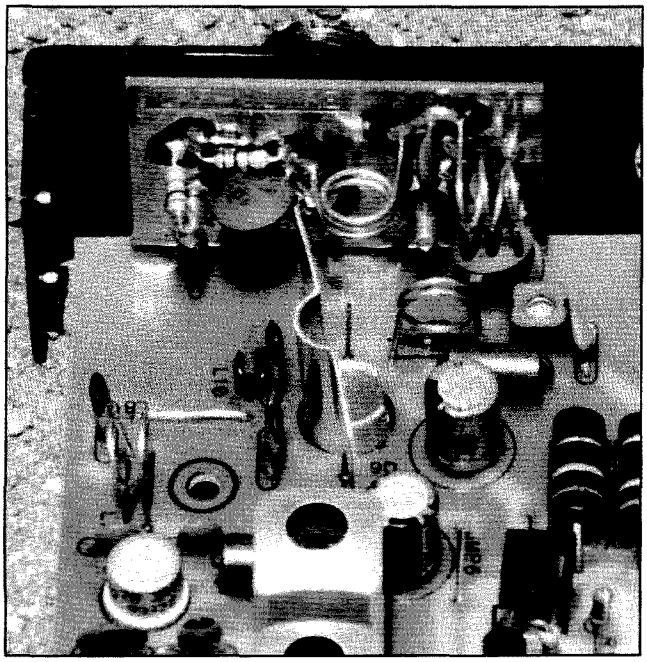

Photo B. The LPF-02 low-pass filter board attaches to the main board with a capacitor lead and two ground wires. L4 is in the center of the board and L3 is to the right.

The crystal is a common parallel-resonant type for nine-times multiplication. Ramsey provides a complete description of its requirements. I ordered a rock for 146.565 MHz from a local supplier and it works fine.

The SlyFox has the same RF circuit as the Ramsey FT-146 2 meter transmitter. The crystal oscillator drives two tripler stages, a driver, and the final. The manual promises 5 to 6 watts RF output with a 13 to 14 volt DC supply, and at least 4 watts at 12.0 volts.

Ramsey's technician told me to expect 5.5 watts at 13.8 volts and over 4.5 watts at 12.0 volts from the factory-wired unit. But in my tests with two well-calibrated Bird Electronic Corporation Model 4431 wattmeters and a UHF dummy load, the most I measured was 4.6 watts at 13.8 volts and 3.45 watts at 12.0 volts. In the low-power mode, output was 920 milliwatts at 13.8 volts.

Not for Beginners

A VHF transmitter is not the best choice for one's first kit-building experience. Ramsey recognizes this, and states in the manual, "To be honest, we'd like to see first-time builders start out with an easier kit . . . but we are confident that you can construct the FHT-1 successfully if you follow this manual carefully and patiently."

Legend has it that in its heyday the Heath company hired men and women "off the street" to test-build Heathkits before they were released. If a non-technical person couldn't make the product work, it wasn't ready to sell. Such testing is not economically feasible today, so it is not surprising to see minor discrepancies in kit manuals. SlyFox had a few. For example, DIP switch positions in the mode tables are reversed from the switch configuration and the paddle dot-dash terminals are reversed in the pictorial. Soldering the center conductor of the coax connector is not called out until this terminal is in a corner and surrounded by other parts, making the task awkward.

But all in all, the assembly instructions are good. Many steps include information on the function of the part being installed, to help you understand how the unit works. Color code and other part identification data is given in every step.

Most parts fit on the 4-1/2" x 5-1/2" main circuit board (Photo A). There is tin-plated etch on one side, and the other side is clearly marked with component designators to aid assembly. The main board also has etch and markings for the optional voice unit parts.

The voice ID area of the board is shaded out in the Parts Finder drawing that you use to assemble the basic FHT-1, resulting in a couple of errors. One jumper needed in the basic FHT-1 is covered up in the drawing. On the other hand, the pictorial shows resistor R11, which is not used unless you add the FHID-1. This could confuse some builders.

A separate 1" x 1-3/4" circuit board holds the SO-239 output connector and a two-section output low-pass filter. Parts on the filter board mount to the etch side, surface-mount style. This board "stands up" at the edge of the main board, held in place with one capacitor lead and two small wires (Photo B). Once constructed, the two-board assembly is very tricky to re-

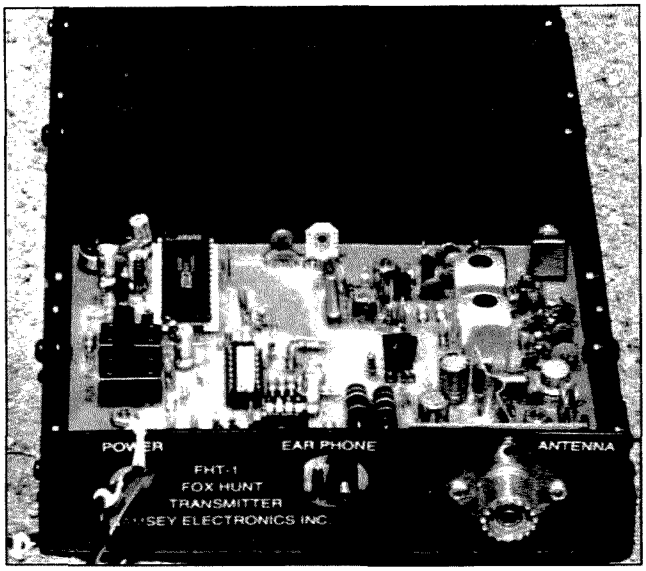

Photo C. The CFHT steel case is rugged enough to protect the SlyFox from abuse in the field. There is plenty of room for a set of C-size batteries.

move for servicing and troubleshooting, because there is no sturdy mechanical attachment of the boards. You can't solder them directly together because the filter board sits on the non-etch side of the main board.

If you plan to provide your own enclosure for the rig, I suggest you have the boards handy when you pick out or fabricate your box so you can be sure to arrange the proper fit. You cannot complete the filter board assembly first because the end plate of your case must be bolted to the coax connector and filter board before soldering the connector center pin.

Ramsey sells a matching enclosure, Model CFHT, for $29.95 (Photo C). Top and bottom are made of steel for ruggedness. It holds the filter board and connector perfectly in place. At 6" x 9-3/4" x 1-1/2", it is almost twice as large as it needs to be. There is room for batteries or another circuit board.

The inductance of air-core coils in VHF circuits is a function of the diameter and spacing of the turns. Ramsey engineers have a clever method for helping you make the four air-core coils properly. You are instructed to wind them on the threads of a 5/16 x 20 bolt, then "unscrew" them to get perfect 5/16" diameter and 1/20" spacing.

Other VHF transmitter kits I have built use a myriad of tiny variable capacitors for tune-up, but this rig has only one to resonate the final tank and one to tweak the crystal oscillator to the exact channel frequency.

Tuning Trials and Tribulations

Any home-built transmitter, whether from scratch or a kit, must be tuned up properly. Spurious and harmonic emissions must be within FCC's stringent limits at high and low power level into any antenna. Final transistor power dissipation must be kept low for long life.

Ramsey realizes that most hams don't own a spectrum analyzer and many have not yet acquired a VHF wattmeter and a good dummy load. So, the instruction manual suggests several flashlight bulbs that can be used to load the SlyFox and indicate power output. Except for some brief experimentation, I used a wattmeter and a UHF load, and I'm glad I did, as you will see.

The first step in tuneup of the SlyFox kit is to verify the output of the first tripler stage using the supplied nonmetallic hexagonal tuning tool. Hey, where's the tool? It's the only missing part in this kit. No problem—I have built enough Heathkits to have lots of them on hand.

Despite careful tuning of the triplers' RF coils, I got zero volts at the first tripler test point. Probing with a DC voltmeter, I found very low voltage on the emitter of the oscillator stage. C23, the coupling capacitor between oscillator and tripler, was shorted.

Unfortunately, the manual doesn't provide any troubleshooting help for this condition. There are no voltage or resistance charts, either. A skilled RF experimenter would have no trouble tracking this defective part, but the task would have been quite difficult for a beginner.

After finding and installing a replacement for the defective C23, I followed the instructions and tuned the tripler, driver, and final stages for maximum output. However, the tripler test point voltages were well below the minimum expected values in the manual. The most output power I could get with careful tweaking was only 2.7 watts. I checked the rig's output on a

Number 19 on your Feedback card

HAM HELP

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I am in desperate need of a Digital Display Board X-54-15-4000 for a KENWOOD TS-830.S. You can call me collect at (718) 919-6072 after 6 PM EST; or write to me, *Juan Mosoller, PAPA INDIA INT'L, P.O. Box 210-417, Brooklyn NY 11221-007.*

I need to get in touch with a technician who is familiar with a ROBOT 800-C Terminal Unit and who would be willing and able to identify and correct a problem within the unit. Also, does anyone know whether the Robot Manufacturing Co. is still in business? I need their address. I would appreciate any and all assistance. *Herman H. Franks WD4IFN/TU4EV, AmEmbassy Abidjan (FMC), Dept. of State, Washington DC 20521-2010.*

WANTED: Software-hardware info for HEATHKIT H-101-20. Computer ham programs are my main interest. *Jerry Weihrauch K0HZI, 475 E. Minnehaha #3, St. Paul MN 55101.*

spectrum analyzer and found that the level of the second harmonic was only 16 dB below that of the fundamental, much higher than allowed by the FCC. In addition, the output transistor got very hot after only a few seconds of operation.

Suddenly, there was a pop and output power went to zero. I thought at first that the final transistor had burned up, but it turned out that Q4, the second tripler, had shorted. This part is in a three-terminal pill-sized case with thin flat leads. It is not available in most local electronics stores, but I found an electrical replacement with four thicker leads, too large to fit in the board holes. I cut off one of the two collector leads and soldered the transistor on the rear side of the board, surface-mount style. I held my breath and powered it up again. Good news—it worked. Bad news—output and harmonics were exactly the same as before.

I spent many hours probing the two tripler stages, assuming that they were not peaking on the proper multiples. That seemed to be the most logical cause for this combination of low test point voltages, low output, and high harmonics. I also compared my kit unit with Ramsey's wired unit. All DC voltages and currents were normal, and the tuned circuits appeared to be OK. So I turned my attention to the final stage.

I noticed that the factory-wired unit's output inductor L2 and filter inductor L4 had much wider spacing than called for in the kit instructions. The manual does not specify any adjustments to the spacing of these coils after assembly. But when I spread the turns on the kit unit to match the factory's unit and retuned the final capacitor, power output increased dramatically.

With back-and-forth adjustments of the output capacitor and all four air-wound coils, I was able to get the kit to match the output power of the Ramsey-wired unit. The second, third, and fourth harmonics of the kit now measure -70, -50, and -70 dB respectively, easily satisfying FCC requirements. All spurious emissions are better than 54 dB below the carrier, and the final transistor runs much cooler than before. The tripler test point voltages are still well below manual minimums, but it doesn't seem to matter.

So if you observe low output when tuning up the FHT-1, try spreading the turns on all air-wound coils to 1/8" apart instead of the 1/20" spacing you get with the winding-form bolt.

My experience clearly proves the need to use good RF test equipment for tuning up this kit. It may be OK to do your initial "smoke checks" with a flashlight bulb load, but I urge you not to put on any T-hunts with this rig until you verify the output power and final stage tuning with a good wattmeter and 50-ohm VHF load. A spectrum analyzer check would be a good idea, too.

An incandescent lamp is not an adequate indicator of power output and signal purity at VHF. If I had trusted only a bulb in my initial tests and not checked further, my SlyFox would still be putting out half power and excessive harmonics. Furthermore, the output capacitor's set point for a 50-ohm load is not the same as for an inductive incandescent bulb. So make friends with a ham who owns a VHF wattmeter. Perhaps your local ham club has one to loan out.

Cycling and ID Options

The SlyFox CW IDer works like an electronic keyer. You will need a set of dot-dash paddles to program in your call. The manual states that the memory holds 10 to 15 characters, but I found that it will take only a total of 32 dots, dashes, and letter spaces. There is enough memory for any US callsign, but not for a long call with a suffix such as KD6ZBB/2.

The internal keyer's clock starts when you send the first dit or dah and continues at a fixed rate until the memory is full. Don't hesitate when sending, or the memory will fill up with spaces. You cannot change the rate of programming or playback of the ID, which is about 13 WPM. The 68HC705 microcontroller automatically sends "DE" before the callsign when playing back the CW ID.

Every transmission starts with identification. You can program the unit to follow the ID with silent carrier, a continuous tone, or to unkey for the remainder of the 60-second cycle. Then the unit executes an OFF period of zero to 60 minutes before keying up again. You can program the power to be high or low, or to alternate between high and low power transmissions.

You can choose only increments of four minutes for the OFF cycle, which limits your duty cycle options. You can get continuous transmission (60 seconds on, zero OFF) or 10 seconds on, 45 off. You can also get 10 or 60 seconds on and increments of four minutes off, but you cannot select such combinations as 10 seconds on and 10 seconds off, or one minute on followed by one minute off, or any combination thereof.

The CW ID memory is volatile, requiring you to install an alkaline or lithium battery to hold your callsign, timing, and tone selection when power is removed. The voice ID add-on does not require a backup battery for voice memory, but one is still needed to hold tone frequency and timing cycle data in the user-programmable mode.

When you add the voice ID option, the CW IDer is disabled, and you won't need the paddles. The voice message lasts 20 seconds, but it is truncated to 10 seconds if you do not select the 60-seconds-on mode. 73

ABOVE & BEYOND

VHF and Above Operation

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10 GHz Operation & Loran: A Poor Man's Grid Square Location System

This month will be a very busy one with both the first weekend of the ARRL 10 GHz contest and the ARRL convention taking place in San Diego. Both events should produce a flurry of activity, consuming lots of time, setting up for either event. I am looking forward to the convention because of all the activities and eyeball QSOs. In addition to getting ready for the convention, we are trying to give our microwave equipment a good shakedown test starting in early May to ensure proper contest-time operation. New items that have been added are given a real stress test for field operations to make sure they won't fail in portable operations.

It seems that most of the time I do not give my equipment the time needed to put it into top shape due to the many different constraints put upon the time I have available for hobby activities. I don't want to put a strain on family activities and the hobby must remain as just that, a hobby. I recommend starting much earlier on equipment checks, leaving lots of time for family activities. I've just got to start earlier next year (as I always say).

This month I will put into practice some of the methods and practices that our San Diego Microwave Group uses to facilitate microwave contacts. Some of the devices we bring into play are very simple and inexpensive, while other items can be a little more complex and costly. In this light I would like to start with a few simple devices that can be put into operation for little cost; then I will cover a surplus Loran receiver system that is used for position control.

10 GHz Contest Preparations

A little background information on our systems might be in order first. In our operations, both high power (10 watts) and low power systems (50 to 100 mW) are used for SSB operations and both produce very good results. While the low power systems are not as "loud" as the high power systems, they are quite readable and log just as many contacts as high power systems. First Rule: High power is nice, but not necessary if conditions are reasonable. First choice: Don't go for power, but improve your receiver noise figure.

MMICs for Receiver Preamps

A good investment in your SSB system would be to make performance improvements in the receiver system, particularly the preamplifier gain and noise figure. If your system operates in the 10 dB or so noise figure range, a tremendous improvement can be made with lower noise figures. If you lower your noise figure from 10 dB to something near 3 dB you will be surprised at the overall performance improvements. It's like having the transmitter at the other end of the path double or quadruple its power output.

What kind of amplifier should I build to attain a low noise figure? Well, there are many devices that are suitable, all of them having GaAsFET-type construction. The basic types are HEMPT-type FETs, which require a stripline design for proper operation at the design frequency of interest. The stripline PC board must be designed to match the device to the specific frequency of interest. Another type to use is the MMIC. This MMIC is a Microwave Module Integrated Circuit and all circuit parameters are matched to 50 ohms on both the input and output of the device. Specific design requirements are not necessary, as in the GaAsFET-type amplifier, making amplifier design quite easy. Most normal MMICs that I am familiar with are good for something up to 2 to 3 GHz at best. While there are MMICs that operate at much higher frequencies, their prices are prohibitive.

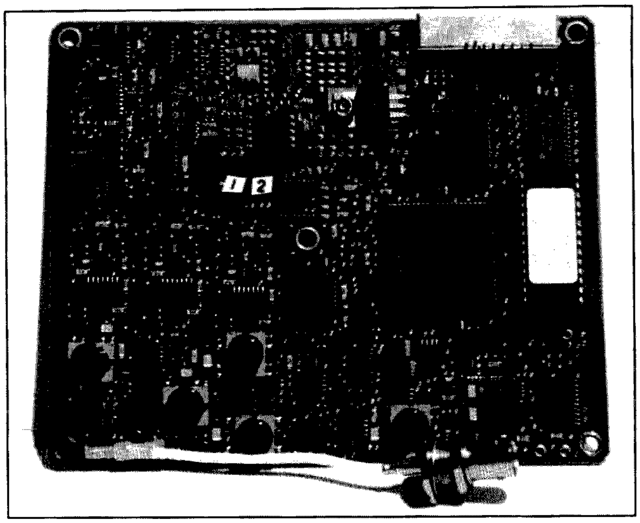

Photo A. LORAN receiver PC board with BNC connector.

Photo B. One of our "secret" surplus yards being observed by Kerry N6IZW. Note the large CRUSHER on the right, (not a space alien or relative of Dr. Crusher of STAR TREK fame). Surplus electronic items are saved from this and other similar junkyard tools of destruction.

However, all that has changed with Hewlett Packard's new MMIC, the MGA-86576 MMIC. The frequency response of this device is good from a low frequency limit of 1 GHz to just over 10 GHz. This device sports about 20 dB of gain over the 1-to-10-GHz range, and noise figures under 3 dB. Now the best part: These devices cost about $8 each in single quantity from Hewlett Packard Distributors. Kerry N6IZW made a circuit test using one of these devices using a 10 GHz stripline PC board that was originally made for a Mgf-1402 GaAsFET, and cut off the tuning tabs leaving only the bias lines and 50 ohm stripline. Usable gain as measured at 10 GHz was 13 dB, and the noise figure was not measured but observed very near the 3 dB estimated. See Figure 1, the MMIC circuit diagram.

I plan to do more testing on this device and have ordered several more devices to experiment with. I will report on further tests as they develop. From the first test runs, this Motorola MMIC device has us very impressed due to the very inexpensive nature and wide frequency band of operation. Add this device to your system and you should see quite an improvement in receiver operations.

Microwave Dish Alignment

The next simple item that can be useful is dish pointing and alignment, specifically vertical dish alignment. When you know where the proper vertical alignment is, its not a problem. However, when you need a calibration marker this is a difficult calibration. How do you construct a calibration device for this purpose? This problem can be easily solved by adding an old meter movement to your dish tripod. This meter movement can be a defective meter from surplus. Mount the meter upside down on your dish, with the center of the meter movement pointing downward. This meter will now serve as an indicator of your dish antenna—use the indicator as calibration marks to reference the vertical angle or incline your dish is now aimed at.

Basic calibration is accomplished by adjusting the meter needle to a reference point when copying a remote beacon or station. First copy a beacon whose position is known; that will give you a good horizontal compass reference. Then, rock your dish in the vertical position for best signal strength and set the meter to its reference. Now you can rock the dish in other test inclines and try for that faraway shot, knowing (without guesswork) a good position (which should be near the correct position) for your dish. This allows you to return to a calibration point without guesswork. It's basically an incline meter from a very unusual source. It doesn't even matter if the meter is any good, just that the meter movement swings free with gravity. You must remove the meter movement spring from the meter for free movement of the indicator on the meter.

The next point is distance alignment, your horizontal compass heading. In this category you need to know where you are and have some method of accurately pointing your dish antenna at the other station. Needless to say, the other station has to know where he is located. A six-figure grid square location is sufficient for this heading. Up on big rock candy mountain near the cutoff, "about 30 miles from wherever" just doesn't cut it. Trying to use locations like that would be like swatting flies blindfolded. It can be

accomplished with maps and other references, but trying to find an unfamiliar location this way takes lots of time away from microwave operation. A big help with map use is to draw out compass directions to popular spots, giving forward and reverse compass bearings. Plan ahead! Know where the other fellow is going to operate from and determine the compass heading in advance. If you have big bucks, obtain a GPS receiver—it will give your location and tell you if you are in the end zone or eating popcorn in the first row. The cost of these devices range from $500 up, mostly *up*. An alternative to this system is LORAN. It's still a toy for me in this application, but an inexpensive toy.

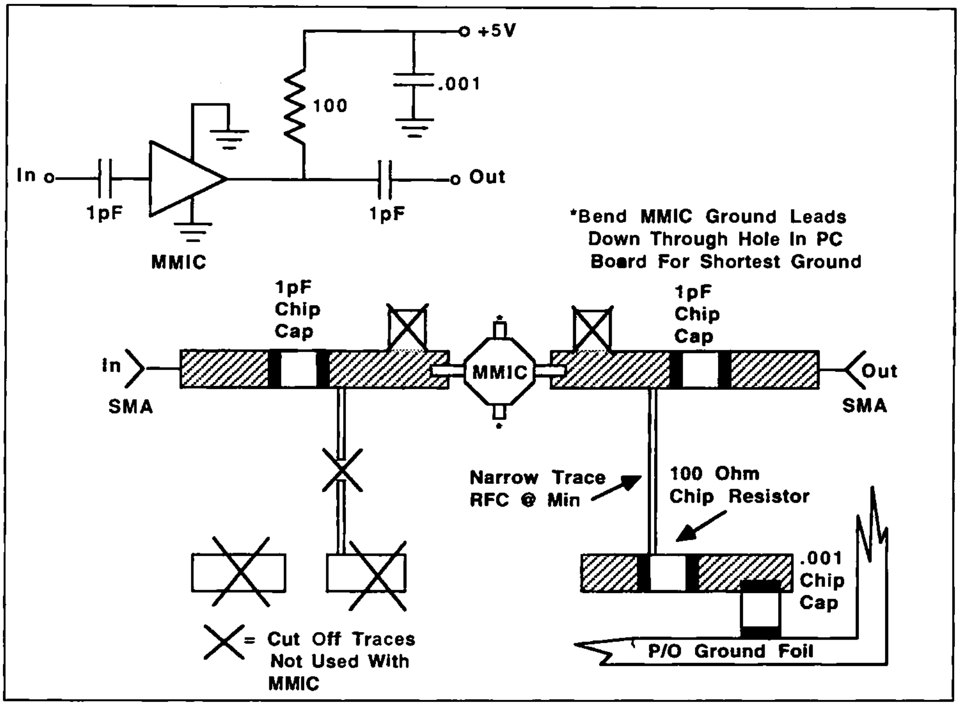

Figure 1. A modified 10 GHz amplifier board, featuring the Motorola MGA-86576 microwave MMIC. Gate bias circuit for FET is not required using MMIC. Circuit produced 20 dB gain at 1 GHz, and 13 dB gain at 10 GHz. Approximate noise figure was 3 dB.

LORAN Location System

Loran was in operation before GPS, and it can give very usable location data. It is not as accurate as GPS but it can tell position with accuracy to about a third of a mile. Its accuracy depends on how well it can receive its location transmitters and it can give results to about to about 2,000 feet or so. In actual practice, Kerry and I have observed the readout accuracy to be about 0.34 mile.

Why use Loran when GPS is available and provides much more accuracy? Price. We located a receiver in surplus and gave it a try. We became so excited by the results that we picked up the whole batch of receivers before they could be lost forever (see Photo A).

Putting the receiver into operation was not difficult. All that is required to put the board into operation is an IBM or compatible PC running BASIC, and a single com port (RS-232). A simple one-chip interface device (Maxim 232 chip) is needed to interface the Loran PC board and the RS-232 port on the computer. See Figure 2, a computer interface adaptor schematic using this Maxim chip.

As you can see from Figure 2, only the Maxim chip and a few capacitors and voltage regulators are required. Minimum connections are necessary to your RS-232 port as only the serial receive and transmit lines are required, making this adaptor easy to duplicate. When your adaptor is constructed, a simple checkout is all that is needed. I blew my adaptor up by not being careful—I had reversed the +5 and +15 volt lines. Don't you make the same error—check your work over before applying power. You can check three times, but you can only apply power wrong *once*! Repairing my wiring error and replacing the chip solved the circuit problem.

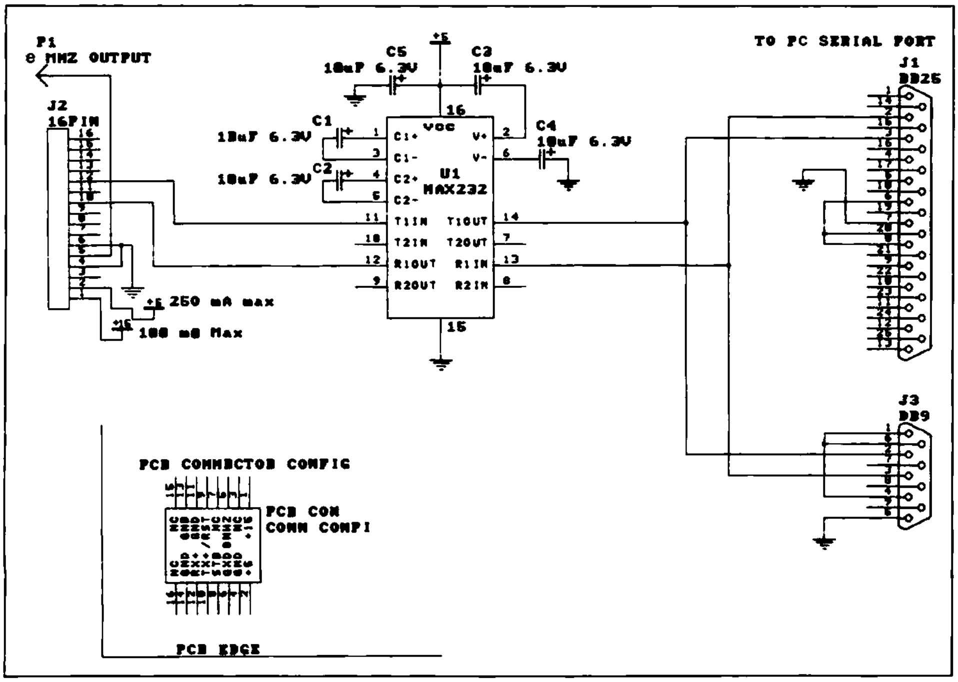

Figure 2. Schematic for Maxim-232 RS-232 PC-LORAN adaptor.

Check it out with a voltmeter. You should have about +10 volts on pin 2, and -10 volts on pin 6 of the Max-232 chip. Current draw is 250 mA at 5 volts and 100 mA at 15 volts. You will need to heat-sink the 5 volt regulator to keep it cool at this current. See Figure 2 for interface pinouts on the LORAN PC board. Only a few pins are actually used. Pin 1 is +15 volts, pin 2 is +5 volts, pins 3 and 5 are grounded. Pins 10 and 12 are the communication ports on the LORAN PC board, with pin 10 a receive command line and pin 12 the transmit line. The schematic diagram also includes a pinout for those computers that use a 9-pin connector for the RS-232 port, like my Tandy 1400 LT.

The computer used was running DOS 3.3 and GWBASIC. The BASIC program sends a data message to the PC board via the RS-232 port instructing the Loran receiver to do a task. The command is: Send the capital letter "A" "carriage return" "line feed" and the receiver will respond with data on position in respect to latitude/longitude, and a certainty factor in decimal on what accuracy or error distance the program calculation has determined to be the maximum error. Kerry put this format into a BASIC program; the listing for this program is shown in Figure 3.

The additional steps at the end of the program are part of a routine to read the Loran receiver oscillator and

report what its frequency is, as compared to a precise cesium or ribidium oscillator at the LORAN transmitting site. The error will be in the transmission medium, which is minimum compared to WWV HF 5, 10 MHz, etc. The Loran receiver's internal program will report the frequency offset of the onboard oscillator and print out the reading. We can connect a frequency counter to the LORAN receiver and monitor this frequency and use it as a transfer standard to calibrate your frequency counter.

The receiver must be receiving Loran signals and be locked up in normal mode. For example, if the program reports the oscillator frequency to be 8.00000234 MHz, your counter connected to the LORAN receiver oscillator pin should read the same frequency to make them agree. Adjust your counter calibration oscillator to make the readings agree. It's a little touch and go, but when LORAN signals are being copied well it gives an excellent transfer standard. Loran master frequency standards are maintained to very near perfection, a few parts in ten to the twelfth. At present there is no reason you cannot obtain calibration to a number of parts in ten to the ninth. We are working on refinements to this step to obtain better frequency transfer results and will report on future findings as they happen.

Let's get back to horizontal dish position and where you are in respect to your horizontal horizon. The LORAN receiver receives a complex signal from a string of stations on 100 kHz and uses the timing and coding pulses to enable the receiver to determine where it is located. This data is part of the serial data that is displayed on the PC computer as the latitude/longitude information for your location. This data could be inserted into one of several grid square programs to allow you to calculate just where you are situated and display the latitude/longitude information as a six-figure grid square location, like DM12LT. The grid square program would have to be modified to accept the data directly from the LORAN receiver. This has not been done at present. but it is a future project. For the time being, operation will have to be manual. Perhaps someone reading this column will incorporate this feature and report back.

The information from the LORAN receiver can be of great benefit to a rover who is working fast-paced contacts to a series of fixed microwave stations operating in contests similar to the ARRL 10 GHz contest. After a set of contacts is made, the rover packs up and moves on to another location 10 miles farther down the road. All equipment and antennas are mobile-mounted, making setup fast. The benefit LORAN would present is determining, with good accuracy, when you are positioned in the area you think you are. For most locations this data can be confirmed by simple map interpolations compared to your surroundings. But when the distance between any distinguishable feature is great, uncertainly is the real answer. Errors in your position can make dish pointing critical at best. Considering that a standard 30" dish has a beam width of less than 3 degrees, horizontal and vertical location is very important for fast contacts on microwave.

Knowing where the fixed station is located is great and can be set up with a compass to good agreement towards that station. However, the fixed station does not know with certainty where you are in respect to a very narrow dish's beam width (less than 3 degrees). If you can provide your location to a specific six-figure grid square and be accurate, this problem can be eliminated with accurate dish positioning and setup. In most cases antennas can be aimed at each other and initial contacts can be made even over paths of several hundred miles. By eliminating wobble from the wheels of frequency and aiming, you will leave uncertainty behind. Knowing where you are and on what frequency provides nearly armchair-quality performance. It's almost like shooting fish in a barrel.

One question remains, I suppose, and that is: How do you take a 100 kHz antenna into the field and make it portable? Well, these systems are made to operate on very short active antennas that have a high-gain preamplifier connected to a short receive antenna for mobile use. An active antenna could be home-brew constructed as its circuitry is not too difficult to reproduce. Power for the active antenna is a normal provision from the LORAN receiver and is furnished on the antenna connector center conductor that feeds the active antenna. In this case 15 volts is supplied up the coax for this purpose. Usually these preamps will operate on anything from 8 to 15 volts at 5 mA or so.

A commercially-produced antenna can be obtained from MAXRAD (available through some ham radio dealers), an antenna products company, for under $50. The basic active antenna model MXLB-100 is $27, and the simplest of antenna mounts (magnetic) model GBN is $15. Performance quoted is -5 dB to unity gain for this compact 100 kHz antenna.

As always, I am experimenting and am working on an active antenna and want to incorporate a ferrite element to give frequency immunity to out-of-band signals that seem to interfere with the basic active antenna circuit. Some of the active antennas are broadband wide-open circuits and as such could receive 60 cycles as well. To prevent this problem I would like to try a simple filter to eliminate out-of-band signals having the antenna resonate at about 100 kHz. A similar problem happened while trying to receive WWVB on 60 kHz. I used a longwire antenna and had so much interference it was not copyable. Placing a filter at 60 kHz in the antenna lead made a marked improvement in performance. I plan to attempt the same thing with the Loran antenna in addition to gain in the circuit. This is still speculative, but some further experimentation will prove or disprove the worth of this plan.

```
10 DIM X$(40)
20 OPEN "ooml:1200,N,8,1,RS"AS #1
30 C$="0D"
40 GOSUB 130
50 GOSUB 180
60 C$="A"
68 S=0
70 GOSUB 130
75 PRINT"   LAT   LONG   ST POSER MODE"
80 GOSUB 180
90 C$="B"
95 S=1
100 GOSUB 130
110 GOSUB 180
115 PRINT
120 GOTO 60
130 PRINT #1,C$;
140 PRINT #1,CHR$(13);
150 PRINT #1,CHR$(10);
160 RETURN
170 GOSUB 180
180 D=0
190 X$(D)=INPUT$(1,#1)
195 IF S=1 THEN 210
200 PRINT X$(D);
210 FOR I=1 TO 100
220 NEXT I
230 V= EOF(1)
240 IF V=-1 THEN 280
250 D=D+1
260 GOTO 190
270 END
280 PRINT
281 IF S=1 THEN GOSUB 400
290 RETURN
400 FOR I=2 TO 5
410 IF X$(I)="F" THEN H(I)=15
420 IF X$(I)="E" THEN H(I)=14
430 IF X$(I)="D" THEN H(I)=13
440 IF X$(I)="C" THEN H(I)=12
450 IF X$(I)="B" THEN H(I)=11
460 IF X$(I)="A" THEN H(I)=10
470 IF X$(I)="9" THEN H(I)=9
480 IF X$(I)="8" THEN H(I)=8
490 IF X$(I)="7" THEN H(I)=7
500 IF X$(I)="6" THEN H(I)=6
510 IF X$(I)="5" THEN H(I)=5
511 IF X$(I)="4" THEN H(I)=4
512 IF X$(I)="3" THEN H(I)=3
520 IF X$(I)="2" THEN H(I)=2
530 IF X$(I)="1" THEN H(I)=1
540 IF X$(I)="0" THEN H(I)=0
545 NEXT I
550 T=H(5)+16*H(4)+256*H(3)+4096*H(2)
860 IF T>8000 THEN T=T-65536!
570 08C#= 8*T/256 +8000000#
575 PRINT
880 PRINT OSC#;" MHz"
710 RETURN
```

Figure 3. Basic program of LORAN receiver operation. This program will print out latitude, longitude, status monitor, position error and Loran mode that the receiver is reporting.

Both Kerry and I have noticed severe interference to the LORAN receiver in tests where the unpackaged receiver was placed on top of or near the computer terminal that was running the BASIC program. Moving the unshielded PC board away from the computer some two feet seemed to cure the problem of the receiver not receiving the LORAN signals. The computer was radiating energy, blocking the receiver. The receiver was connected for these tests on the workbench without benefit of a shielded box or feedthrough capacitors for the DC or computer port connections. This, like anything else, is not a finished product, but it is a starting point, and it provides the fun of picking through surplus material for toys to play with. (See Photo B.)

Well that's it for this month. I hope that the information provided here will assist you with microwave operations in remote locations. Whether you choose to use Loran or GPS for position accuracy is a matter of choice. We have operated without benefit of systems such as this and had a good time. However, it's another toy to put into the toy box for fun, and it offers operation improvement. I hope to have enough time to be able to report further on the LORAN receiver active antenna project and LORAN operation in general next month.

I have a quantity of LORAN receiver PC boards and will make them available for amateur purposes. Tested LORAN PC boards are $25 each postpaid, to U.S./Canadian destinations only (contact me at the address at the beginning of this column). As always, I will be glad to answer questions about this and other related VHF, UHF, microwave subjects. 73 WB6IGP Chuck.

ASK KABOOM

Number 21 on your Feedback card

Your Tech Answer Man

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Intermittents!

Last month, we were discussing clipping, and I promised to go over its effects in the digital realm. So, let's finish that up before we get to this month's topic.

Playing the Numbers

Digital signals can be created in two ways: from digital information, such as that coming from a microprocessor, or from analog information, after passing it through an analog-to-digital (A/D) converter. With digitally-originating signals, parameters are well defined; You always know the makeup of the signal. After all, there are just so many codes to go around, given the number of bits for which the circuit is designed.

Analog information, however, has no such tidy rules. If you're going to convert a changing voltage into a representative series of bits, you must set some limits. How do you know how big the analog signal will be? You don't, at least not exactly. Sure, you can scale it to some approximate level, using amplifiers for gain and resistors for loss. But, there's no way to ensure it'll be *exactly* the optimum size, which is whatever will use up all the available digital codes without trying to go past the highest one. So, what's to prevent your making the signal a little too small, just to be sure it doesn't overdrive the A/D converter? Well, nothing, but you'll be wasting some bits, due to their never getting turned on.

Stop!

In effect, though, an A/D converter is self-limiting. As the input signal reaches the level beyond which the converter cannot generate a higher number, it just keeps outputting the highest number it can until the signal drops below the limit. The result is a digital signal which represents clipping much like the kind you get with an overdriven analog amplifier.

But it's not exactly the same. In theory, it should be. In a real analog circuit, though, clipping doesn't occur instantaneously. Rather, the circuit's gain begins to get non-linear as the signal approaches the acceptable limits, and then full clipping occurs soon after. The result is what you might call "soft clipping." An A/D converter, however, stays completely linear up to its limits, and then it clips completely. So, the resulting square waves have very steep sides, making for a particularly ugly kind of distortion called "hard clipping."

So, if you clip an A/D converter, the resulting bits will represent a highly distorted version of the input signal. It's important to remember, though, that those bits themselves are perfectly fine, and the rest of the digital system can process them with no trouble; they just don't represent what you wanted.

Can you clip a digital-to-analog (D/A) converter? No. Bits come in, and whatever they represent comes back out as analog. Bits themselves can't clip. Of course, if they represent a distorted signal, that's what you'll get. But you can't fault the bits or the D/A converter.

Well, I think that about does it for clipping. Now, let's get to something else.

A Bad Night's Sleep

Wanna give a technician headaches and nightmares? Just sneak up and whisper the word "intermittent." That ought to do it! Nothing in the wonderful, wacky world of electronics is more frustrating. Why does something work, then not work, and then work again?

Plenty of things can cause intermittent operation, but by far the number one cause is a bad connection. Big deal, right? A few minutes with a magnifying glass and a soldering iron and all will be fixed. Well, think again. Sometimes, finding the problem can be easy, but often it is very difficult, and now and then it's just plain impossible. Let's take a look at the different kinds of bad connections you can run into and how you might smoke them out.

Leaves Me Cold

When is hot cold? When it's a cold solder joint! Many intermittents are caused by bad joints. Sometimes you can see the darned things, while other times they look perfectly normal. If you see dull, crumbly looking solder, chances are you've got a bad joint. Especially if you can see the component lead sticking out, with obvious cracks or space between it and the solder around it, you can be sure that joint's cold. How do solder joints get that way? Most are born that way; not enough heat was used to make the joint. Remember, solder isn't just globbed on; it's supposed to make a molecular bond. It takes significant heat to do that, and, if the temperature doesn't go high enough during the soldering process, the bond won't form. Typically, though, the joint will work for awhile—at least long enough for the unit to pass quality inspection and be shipped out to you. In your home, of course, it starts to die fast. Sometimes it's not so fast. I've seen cold joints which worked fine for years and then suddenly went bad.

But, you say, most devices aren't

UPDATES

Number 23 on your Feedback card

HI-PER Audio Filter

With regard to the above mentioned project, which appeared in the May, 1994 issue of *73*, page 10, please note the following: The PC board component placement overlay (Figure 3) shows the polarity for the DC input in reverse. To see this more clearly, please refer to the schematic (Figure 2) where C16 is correctly polarized across the DC input.

The Parts List and overlay call for C17, but C17 does not appear on the schematic. The schematic should show C17 parallel to C3, going to ground. This was omitted on the schematic—it is correct on the overlay.

C1, 3, 14, and 16 are 100 µF 16V electrolytics according to the Parts List, but on the schematic C1 and 14 are called 10 µF caps. Either value will work well; the values are not critical here.

Fast Charger

Refer to the above article in the May issue of *73*, page 22. The article recommends a TK4355 inductor for L1, but that part is no longer available.

A suitable replacement can be found at Radio Shack, with a slight modification. The RS part #273-102 is a 100 µH coil. "Fast Charger" requires a 47 µH coil for L1. To modify the RS part, simply unwind half the windings, scrape off the protective enamel coating from the end and resolder.

hand-soldered anymore. How can a wave-soldered board have this problem when the entire board has been dipped in a molten solder bath? Actually, most cold joint problems I've encountered have been on wave-soldered boards. Apparently, the heat sometimes just isn't turned up high enough. The small parts come out fine, but the larger ones sink enough ol the heat that their leads don't get hot enough to form the proper bond. That results in the classic "lead sticking out lrom hole in the solder" syndrome. In fact, this problem is so common I recommend checking the leads of big components first, particularly on wave-soldered boards. On the other hand, I haven't seen too much trouble with surface-mounted devices (SMDs), probably because they're so small that they get plenty hot enough for proper bonding. Also, special low-temperature solders are used with those parts.

Gets Me Hot

Operating heat sometimes can create cold joints. I've seen anode caps on transmitting tubes actually lose the solder where the caps joined their wires. I don't mean that the solder melted—it actually disappeared altogether! The cause? The heat ol the tubes. Or perhaps it was the high voltage; I don't know. It's also possible for power transistors and resistors to fry their joints, although the solder usually doesn't disappear, it just gets dull and crumbly.

Wiggle It

A great way to find cold joints is to gently wiggle the board, taking care not to get shocked or cause unwanted signals to enter the circuit through your finger. The best way is with an Insulated tool of some kind. For small boards, I like to use a cotton swab stick with one end cut off. I hold the cotton end and use the stick to press on the board, pushing on various spots until I can localize the reaction. For bigger assemblies, I use the insulated end of a small screwdriver.

Does it work? Sometimes. But often, I think I've found the right spot, only to discover much later on that the real trouble was nowhere near where I was pressing. Unfortunately, the effect of leverage sometimes can cause greater movement somewhere across the board than where I pushed. I've had some tremendously frustrating times with that sort of thing.

"A great way to find cold joints is to gently wiggle the board, taking care not to get shocked or cause unwanted signals to enter the circuit through your finger."

Cracked Up

Not all intermittents are caused by bad solder joints. Tiny cracks in PC boards used to be big offenders, but I haven't seen much of that kind of trouble in awhile. I suspect that improved board-making techniques have reduced the problem. Still, if an Intermittent rig has been dropped, and you can't find bad joints, suspect a board crack. With reasonably sized, single or double-sided boards, fixing cracks isn't hard. But, with multilayer boards or the very fine lines you are likely to find in a modem HT, you may be looking at a disaster.

Going To Extremes

Some intermittents are caused or exacerbated by thermal changes. With cold solder joints, changes in temperature can result in a connection's going on and off again. Also, some damaged semiconductors can exhibit the same behavior. If the rig works at first and then goes wacky (the usual scenario), get some coolant spray and start spraying parts around the suspect areas. When you hit the right one, you'll know it, because the circuit will start working again, at least for a few minutes. If, however, the radio misbehaves at first and then settles into normal operation, use the coolant spray to make it screw up.

In some cases, you can also make great use of a hair dryer. If you already have one, it's cheaper to use it than to buy coolant spray. Also, heat will sometimes uncover a problem that the spray will miss. Usually, the added heat will make a circuit go bad, unless the problem is one of those unusual, reverse types which gets better when hot. Just remember that you don't have the same kind of pinpoint control, and you don't want to start melting anything, which is a real possibility with a hair dryer. *Never* use an industrial heat gun—they're just too hot.

So, what makes parts heat-sensitive? With transistors, cracks in the semiconductor substrate or partially disconnected internal connecting wires can do it. With IF coils and such, it's usually a bad solder joint inside, where the tiny coil wires join the form's leads. Now and then an actual break in the wire can do it, because the ends touch. It's rare, though. Resistors and potentiometers can have tiny cracks, and they can be very hard to find, because they react both thermally and physically when you flex the board.

Finally, always check switches and relay contacts for intermittents. Any time you pass a signal through a mechanical, unsoldered connection, you're looking for trouble. Relays are big offenders.

Well, I hope you don't have nightmares from thinking about intermittents! I know I've had plenty of them. Now, let's look at a letter:

Dear Kaboom,

I have a big junk box with lots of different kinds of parts from old radios, TVs and even a radar detector. Unfortunately, many of these potentially useful goodies don't have standard markings like 2N or 2SC. Are there any publications which could cross-reference the odd numbers? Also, are there any books of technical data for transistors and ICs?

Signed,
Electron Wanderer

Dear Electron,

Many of your parts probably have "standard" numbers you don't recognize. There are various systems in use throughout the world, and some don't show up here in the USA enough for us to become familiar with them. Check with an electronics supply house, either locally or via catalog, and you should be able to get some cross-reference books. But beware: Some parts are marked only with "house numbers," which are made up by manufacturers for their internal use. There's no book which can help with that. As for technical data books, Motorola, Ti and all the other big manufacturers sell them, and having a few is an absolute must for serious experimentation or troubleshooting.

Until next time, 73 de KB1UM.

73 INTERNATIONAL

Number 24 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy,
N. Swanzey NH 03431

Notes from FN42

The June ARRL VHF/UHF contest was held last weekend (June 4-5). This has become one of the fun ham weekends in the Keene, New Hampshire, area through the years. We try to come up with a respectable score with our limited efforts: 6m, 2m, and 70cm (SSB and CW) and 223.5 MHz FM. Even though this year's totals were down from past years, we had a good time.

VHF/UHF contests can be a lot of fun even if you only have one band. We heard many operators operating FM simplex from hilltops or mountaintops with just their mobile radios and antennas. Plus, many of those operators operated for just a few hours to give others a point or two. It was also amazing just how far you can hear an FM simplex signal if good locations are available. One that I remember was on 223.5 MHz from the New Jersey area to us in New Hampshire, and we were using an omni antenna, no beam, and an IC-37A, no amplifier.

Don't let lack of equipment keep you from giving it a try.

Another fun ham weekend takes place every June, namely Field Day—which this year took place on June 25-26. This is another kind of event for which you don't need a lot of sophisticated equipment to have a good time. You can even operate from your own QTH if you don't want to get involved with emergency power. I know of many who feel it is the most enjoyable event of the year, taking their low-power HF rig, a wire dipole, and car battery, and making a family camping weekend out of it. As you can imagine, many other campers show up to ask what the ham is doing; some stick around to find out about ham radio, others just walk away shaking their heads.

However you do it, Field Day can be a great amount of fun with a bunch of your friends.

I received a great letter today from Gerard Paquette VE2AW, with an enclosed QSL card confirming an FM contact with a high-altitude weather balloon repeater launched from Hawkesbury, Ontario, Canada, on 30 October 1993. Mine was just one of approximately 500 two-way contacts made to Gerry by radio amateurs in the United States and Canada.

This contact was made with a radio with an output of about 15 watts into a 14-element horizontal beam. If you consider that the balloon repeater was probably using a vertically-polarized antenna, I feel very lucky that it even heard my horizontal signal.

If you have any questions to ask of Gerry, or maybe even some monetary support to offer, contact him at: A/S Gerard Paquette VE2AW, 890 rue Hudson, McMasterville, QC J3G 5C3.

Until next month, 73 de Arnie N1BAC.

Roundup

England *[Information from Ted Melinosky K1BV, The K1BV Directory of DX Awards, HCR 10-Box 837A, Spofford NH 03462]* From Fred Handscombe G4BWP: "I am happy to inform you of my appointment as Radio Society of Great Britain (RSGB) HF Awards manager. All applications for RSGB Awards (except IOTA) should now be sent to me. Some very old information exists and several award managers still receive mail. I hope the RSGB programme will now enter a period of stability in its management!

"I also act as the National QSL checkpoint for UK applications for overseas awards, where this is an acceptable method."

An information package of the latest RSGB HF Awards is available from Fred Handscombe G4BWP for £1.50, $3.00, or 5 IRCs to cover airmail postage. Fred's address is: Fred Handscombe G4BWP, RSGB HF Awards Manager, Sandholm, Heath Farm Road, Red Lodge, Bury St. Edmunds, Suffolk, IP28 8LG, England.

Switzerland *From the International Telecommunication Union Press:* The ITU Council adopted unanimously on May 10, 1994, a resolution authorizing the Government of National Unity of South Africa to resume its full participation in the conferences, meetings, and activities of the Union with immediate effect. The Chairman of the Council, Mr. Souleymane Mbaye (Senegal), informed the entire membership of the Union the same day.

The Council is the management body which meets once a year and acts on behalf of the Plenipotentiary Conference when the latter is not in session.

The ITU Plenipotentiary Conferences had successively adopted resolutions in 1973, 1982, and 1989, which excluded the Government of the Republic of South Africa from the Plenipotentiary Conference and from all other conferences and meetings of the Union. Resolution 12 adopted in 1989 by the Nice Plenipotentiary Conference had provided for the continued exclusion of the Government of the Republic of South Africa until the elimination of the apartheid policies.

The most recent developments in South Africa, culminating in the holding of the first free democratic elections, led the Council to consider that the apartheid policies had ended and hence to decide to repeal Resolution 12.

The next Plenipotentiary Conference will be held in Kyoto, Japan, September-October 1994. For further information, write to: International Telecommunication Union, Place des Nations, CH-1211 Geneve 20, Switzerland. Telephone: National (022) 730 5111; International + 41 22 730 5111; Telefax +41 22 733 7256.

Taiwan *Letter from Bolon Lin BV5AF:* Some information for your reference: BVIØSAT—May 15-22, For Taiwan AMateur SATellite Association (TAMSAT): QTH Changhua 500, Mid-Taiwan area; QSL via BV5AF, P.O. Box 39, Changhua 500, Taiwan.

BVØRI—June 12-15 for Rotary International 1994 Convention; QTH Taipei, Taiwan; QSL via CTARL Bureau, P.O. Box 73, Taipei 100, Taiwan and/or P.O. Box 93, Taipei 100, Taiwan.

BV5EV, Handler/Operator: Linda Lai, YL student; QTH Changhua 500, Taiwan; QSL via Ctarl Bureau, P.O. Box 73, Taipei 100, Taiwan. *Bolon Lin, BV5AF, P.O. Box 93, Taipei 100, Taiwan.*

Turkish Republic of Northern Cyprus/USA *Letter from Igor Zdorov KUOJ:* The Turkish Republic of North Cyprus (TRNC) celebrated its 10th anniversary in 1993. In 1992, after a law authorizing ham radio there was passed, the Telecommunications Administration of TRNC issued the first license to 1B1NCC, Northern Cyprus Club. After that, four permanent licenses to local hams, 1B1AA, AB, AC, and AD, were issued. Unfortunately, 1B1AC passed away in the summer of 1993. Nevertheless, ham radio in TRNC is gaining its momentum. In 1993, 1B/DK7ZZ was on the air for two weeks, followed by my almost-three-weeks-long operation as 1B/KUOJ in December. Because both 1B1AA and 1B1AB were overseas on business at that time, and 1B1AD was using mostly phone, I put my emphasis on CW and made about 10,000 QSOs on all HF bands 10 through 160, including WARC. Over 50% of my contacts were with state-side hams.

In March-April of 1994, Baldur

1B/DJ6SI was on the air for a while, and I provided Eric N1CYA with the info on getting 1B license procedure, his 1B/N1CYA operation pending In April. By the way, I would not recommend trying a 1B operation without a license. I surely was glad I had mine when the local police came and asked about my antenna.

Upon my return home, I read that Cliff KR4M had tabled his petition in favor of TRNC recognition by DXCC, as I found out later, for very unfortunate personal reasons. After discussing this matter with Cliff, I filed my own petition, which was received by DXAC on 2-2-94.

Recently I made presentations to DX Associations of six different states (TX, OK, KS, MO, IA, MN), at which I showed the slides of my 1B operation and discussed my petition. The reaction was overwhelmingly positive; a few questions were asked, but no opposition was encountered. I do acknowledge, however, the existence of some opposition among hams against TRNC recognition by DXCC and I will keep addressing their arguments as soon as I become aware of such.

I am glad to see that even the opposition agrees that DXCC criteria, like "... society united together, occupying a definite territory and having a definite population, politically organized and controlled under one exclusive regime, maintaining a standing army, customs, currency and stamps" are met. The following is my response to the arguments I have come across lately:

•Authorized Use of ITU-assigned Call Sign Prefixes: After declaring its independence, TRNC was left without ITU-assigned prefixes, since the Republic of Cyprus (South) kept total control over their usage. When, almost 10 years after TRNC declaration, a law authorizing amateur radio in TRNC was passed, the Telecommunication Administration of TRNC, to avoid any additional problems with their southern neighbor, adopted 1B as a prefix, not used by or assigned to any country. Several cases set a prerogative for this, such as 1AØ, 1S, SO, FS, all of which are, by the way, recognized by DXCC as separate countries.

•The ability of "engaging in foreign relations—Including capacity to carry out its obligations under international law and applicable international agreements." TRNC is actively repaying its foreign aid loans (annual payments balance rise is about 14%), and has trade relations with more than 60 countries, including U.S.A., Japan, and UK. It stimulates foreign trade by liberal tax concessions, establishing a free port zone in Famagusta, free exchange of foreign currency/stock, and controls foreign investment policy. It provides (and pays for) postal service to any country, telephone and other communications all over the world, and is an observer member of International Islamic Association.

•Low level of diplomatic recognition is the result of failure of the U.N.'s inconsistent attempts to resolve the Cyprus problem in more than three decades, and should not be held against TRNC. Despite the official diplomatic recognition by Turkey only, acting as a responsible member of the international community, TRNC supports representations in 10 countries, including Western Europe, Japan, and the U.S.A., where it has two consulates, one of which is accredited to the U.N. in New York. From the DXCC's standpoint, the fact that North Korea is, out of the whole Western Bloc, recognized by Sweden only, did not make it ineligible. Other examples may be given.

•"Continued talks about reunification" between Greek and Turkish Cypriots are purely symbolic. These talks, conducted through the U.N., have not brought any progress since 1975, and are not expected to bring any progress in the future. This opinion Is shared by TRNC Consulate in Washington, D.C. The talks are basically deadlocked because the U.N., on one hand, recognizes the existence of TRNC and the rights of Turkish Cypriots, but *on* the other hand, treats the Republic ol Cyprus (Greek South) Government, as the sole government of the island, which, in turn, fails to acknowledge the rights of Turkish Cypriots. Talks on reunification of Germany took close to 40 years. DXCC did, however, count German Democratic Republic as a separate for over 17 years prior to reunification, while the talks were going on. The Important difference is that the division of Germany was not based on ethnic differences and was not initiated by any group of German people on either side. The chances of the reunification of the two ethnic communities of Cyprus, which have lived separately on the island for many centuries, are way less than the chances of reunification of Bosnia and Serbia.

And, last but never least, I would like to stress that, after my recent visit to TRNC, 1 strongly feel that this country does deserve DXCC recognition. *[Igor Zdorov KUØJ, 5980 Anna Ave. #308, Minneapolis MN 55432]*

AUSTRALIA

David Horsfall VK2KFU
PO Box 257
Wahroonga NSW 2076
Australia

In my last news from Australia, I mentioned how the Spectrum Management Authority (SMA) was overhauling the licensing scheme (for all classes—business, Amateur, and CB) in Australia. Combined with the long-awaited changes to the Amateur Regulations scheduled for the end of this year, we can look forward to some interesting times (remember that Chinese curse?).

The new Amateur regulations, foreshadowed almost two years ago and delayed for one reason or another, will mean greater deregulation for Australian Amateurs, and amongst other things will allow Novices to use packet radio (currently they cannot), permit the codeless "Limited" Amateur to use 10m FM, and create a "Codeless Novice" class of licence. These changes are expected to create an influx of people into the Amateur Radio Service, which is languishing for lack of numbers; youngsters these days are more interested in playing with their computers than talking to the other side of the world.

With these changes comes greater responsibility, and there are moves afoot to make the Amateur responsible for resolving all cases of interference; a spectrally-pure signal will no longer be a defence, and as Australia has comparatively lax EMI standards, it has become a dumping ground for the rest of the world.

I also mentioned in the last column the madness that seems to have infected the VK2 Division of the Wireless Institute of Australia (WIA). Sanity was expected to have returned at the Annual General meeting, but no—the election outcome was successfully challenged on the grounds that it was not conducted according to the Articles of Association; the Returning Officer was not permitted to conduct the ballot, proxies were not authenticated, and several dubious Reports to Members and "How to Vote" guides were circulated. At the time of writing, an amicable solution to this crisis is being sought; one that does not involve going to court and subsequent legal bills. A fresh election, conducted by a neutral third party, would appear to be the preferred option. In the meantime, it would appear that the only person who has any authority within the VK2 Division is the paid Administrative Secretary, as it is generally agreed that a new Council was not elected after all.

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2AAB.SYD.NSW. AUS.OC" and "dave@esi.COM.AU" respectively. I'm not sure whether all messages are being delivered to my packet address, so if you don't get a reply, it means that I didn't see iL 73

NEVER SAY DIE

Continued from page 4

me into amateur radio was *QST* magazine. Our school library had a subscription, so when I wanted to know more about amateur radio I went to the library and started reading. It sounded like fun, so I joined the school radio club, where I was able to get on the air. The club station was W2ANU on 160 meters. Well, that was about the only voice band Class B amateurs could use, and most of us were Class B back then. This was in 1937.

Will today's youngsters be able to go to their school or public library and find out what's happening in amateur radio? That's what got me going, so check it out and see if your local school libraries have subscriptions to *73* and *Radio Fun*. They probably don't unless you've donated the subscriptions. So I'll tell you what, if you'll do your bit to help interest youngsters in amateur radio by springing for a combo subscription for *73* and *Radio Fun* for your local school and your local public library, I'll go part way with you. You might even want to come off as Daddy Warbucks by giving subscriptions for your radio club library too. Subscriptions to the two publications would normally cost $33, but if you send me $25 we'll send the libraries you select a subscription to both magazines with your compliments.

Here's your chance to help amateur radio recruit new hams. Your $25 can do a whole lot of good. Send your subscriptions to: Library Special, *73* Magazine, Peterborough NH 03458-1107. Cash, check, or credit card. Or call us at 603-924-0058.

Book Bargain

If you ever find yourself short of things to talk about on the air, you could do worse than get a copy of kindly old Uncle Wayne's *Declare War* book. It's time to put the few copies we've got left in the warehouse on sale.

Book? Okay, in case you are either a newcomer to *73* or have advanced brain rot, here's what happened. Coming on to three years ago, when the recession was at its worst, the governor of New Hampshire, unable to think of anything much to do about the situation, got the Legislature to authorize an Economic Development Commission to help him cope with the disaster. Yes, he appointed me to the Commission, even though I warned him that I would be at the least a royal pain by insisting that we accomplish something.

It didn't take me long to discover that most of the very important businessmen and even more important politicians on the Commission were too busy with other things to devote much time or thought to the job. So, for over a year, I attended Commission meetings and endless subcommittee meetings. I sent reports to the Commission members of what I was finding as far as our problems were concerned, and then I suggested inexpensive solutions. A few members were enthusiastic about my reports. The rest I didn't hear from. When I saw them or called them and asked what they thought they said that, well, ahem, they hadn't had time to read them yet.

So I reprinted my reports in book form and sent it to the Legislature, most of whom didn't read it either. I wasn't set up to handle national distribution, so I settled for getting the book into New Hampshire bookstores. It sold well and brought me many compliments. No negatives from anyone yet. I've advertised it in *73* and sold several hundred copies, again getting many nice letters commenting on my approach to solving our more serious national problems.

Now I'd like to clean out the copies that are left, so instead of the $13 published price (plus $3 shipping and handling), I'll send it to you for $10 postpaid.

So what's in the book? Well, there's a wealth of entrepreneurial ideas. When I took a look at the major problems facing New Hampshire and America, I looked for creative solutions. Not having seen socialism succeed anywhere in the world in history, I've tended to avoid calling on the government for intelligence or answers.

What kind of problems? Well, little things like our high crime rate and how to tackle it. The high cost of prisons and shortage of prison space—the welfare mess—our rotten school system—the high cost of a college education—how we can cut the bloated government bureaucracy in half in three years—how we can cut taxes and get rid of the deficit—solving the drug problem—building a high-tech workforce—ending poverty—making Congress honest. Things like that.

Sure, I've written about some of these things in my editorials, but the book has 360 pages of my findings and ideas. You may find this difficult to believe, but I even express some opinions—and I'm well known for being almost totally unopinionated. I think you'll like my proposal which will provide unlimited prison space for a fraction of what we're paying now and result in re-educated and motivated exprisoners. I think you'll like my college plan which will provide free tuition and a three-year degree.

Send or call in your order (603-588-2105) to Uncle Wayne's Bookshelf, Peterborough NH 03458-1107. This book is so good I can almost guarantee you'll like it so much you'll be reading it over the air. If you paid the full bore I would guarantee it.

One Million Dollars?

One result of my offering advice in my business publications such as *Music Marketing, Music Retailing, Ham Radio Marketing, Microcomputer Marketing*, plus articles in *Folio, Inc.*, and so on, has been a series of consulting gigs. While there are as many problems as there are businesses, I found some that almost all businesses had several in common.

The three almost universal problems are (a) lousy PR, (b) lousy advertising, and (c) lousy direct mail follow-up on advertising and promotion. Why the owner and CEO of a company would go to all the expense and trouble of developing a really good product, only to kill it with lousy marketing, is difficult to understand. I guess it comes down to either remarkable stupidity, or else a lousy education in the fundamentals of business.

What's more basic to selling a product than advertising? Yet there are few schools teaching the subject. Worse, all too many of the big ad agencies don't seem to have anyone around who's ever studied the fundamentals. When you consider that a good ad can easily sell 10 times as much product as a crummy ad, this is not something you want to trust to a high-school dropout. That's like a manufacturer letting a rig be designed by a Novice.

"A simple new product release in a magazine will, on the average, result in about the same increase in sales of a product as a full-page ad."

Since there already are books and courses available for anyone interested in learning about advertising, and I'm not interested in writing something that is already available elsewhere, I haven't yet written an advertising primer. Maybe one of these days.

When I started my first business, manufacturing loudspeakers, I quickly discovered that I couldn't depend on agencies for anything beyond doing the mechanicals for my ads. I'd have to design and write them. I bought some books, which were OK, but not great. One of the best moves of my life was to sign up for a course in advertising with the Advertising Club of New York. Their lecture series was superb. They not only covered how to design and write ads, but how to handle ads in magazines, newspapers, radio, TV, billboards, posters, and even matchbook covers. Changed my life.

Promotion!

The easiest way for any company to generate more sales without a lot of expense is to go the promotion route. There's a lot to learn about this. There are obviously some sneaky tricks the professionals use to make sure their material gets before the public. As a publisher of some of the larger magazines in the country, I knew that not more than a handful of experts had even an inkling of how to get new products releases or product reviews published.

From my viewpoint, most companies are throwing away sales. A simple new product release in a magazine will, on the average, result in about the same increase in sales of a product as a full-page ad. A good product review will sell as much as four full pages of ads.

If you use the normal magazine guideline, an ad, if it is any good, and is in a magazine reaching good potential buyers, should sell at least 10 times the cost of the ad in product. Thus, if a page ad in a magazine costs $8,000, an advertiser would expect to get at least $80,000 in sales as a result. Now, if we figure that a company has at least four new products a year and thus is able to get four new products releases printed in a magazine, plus maybe two product reviews, that should provide the same sales as running a dozen full-page ads—so we're talking about an additional $1 million in sales, all from absolutely free advertising!

In the ham radio field, where ads are more like $1,500 a page, that's still an added $180,000 in sales—if you know how to write the new products releases and get them published.

To help business people take advantage of the power of promotion I made a one-hour video explaining exactly how to do it—giving away some secrets that have made a few other publishers furious. I've been selling the video for $100 with a money-back guarantee. No one's asked for their money back yet, and I've sold several hundred of them. They're even being used by a couple of colleges as part of their advertising courses.

Now I'd like to make this video available to interested *73* readers at a big discount. How about $40 plus $3 shipping? That's my $1 Million Video. Send a check or your credit card number to Uncle Wayne's Bookshelf, Peterborough NH 03458-1107.

It really doesn't make much difference what kind of a business you are in—PR is an inexpensive and very effective way to generate sales. But, you know, not one company in a thousand knows how to get all this free advertising. Maybe one in ten thousand. And that includes some very large, but not too brilliantly run, companies.

Is it worth $40 to you to generate a few thousand dollars in extra sales? Probably not. Too much trouble. Yawn.

With some encouragement I'll do a video on how to double your business with a better follow-up on reader's service cards. Or at least I'll write a book. A video would be better so I could show you how stupid some manufacturers are in preparing their literature. You won't believe it if I don't show you.

Chicken Little

When one of the non-publishing WGI divisions managed, through spectacularly poor management, to rack up unexpected losses, I knew I'd be able to count on at least one Chicken Little to blow this out of proportion. I was not disappointed. Fred W5YI, who seems unable to keep himself from avoiding any such opportunity, stepped right in with his appropriately-colored pink sheet.

The only way I'm able to "run" so

many different businesses without being tied down 24 hours a day is to pick the best managers I can and give them the authority to run them. Most of the time this works out fine, but now and then one screws up—and then of course covers up. In this case it was with the IMPS Manufacturing Division.

This is the Independent Music Producers Syndicate, which has been brokering the manufacture of compact discs for over a thousand independent record companies. The team running it managed to lose a bundle through loose credit policies.

Yes, I should pay more attention, but I had no reason not to trust the creative financial reports I was getting, and I was spending most of my time researching and writing—work which resulted in my *Declare War* book, and a soon-to-be-finished *Declare War II*, or *Son of Declare War*. Plus I was also writing editorials for *73*, *Radio Fun*, *"Cold Fusion"*, *Music Retailing*, and *IMPS Journal*. Getting *"Cold Fusion"* started took extra time too, what with my having to bone up on the latest fundamentals of physics, chemistry, atomic theory, quantum mechanics, and even chaos theory. So I got blind-sided. Hey, I'm only one guy, and I'm old. Say, where'd I put my walker?

Despite Fred's enthusiastic Chicken Little alarums, *73* is doing just fine, thank you, and it's no more for sale than it's ever been. When I found out what was really going on I dumped the CD brokerage business and concentrated our efforts on the cold fusion field, which I'm convinced is going to have more of an impact on the world than any other development in the 20th century. That left me with a warehouse full of CDs to sell to clean up our debts. Fortunately they're all superb music, so we'll be providing some incredible music bargains for anyone who likes music. And if you don't like music, you're a very disturbed person and have no business reading my editorials.

When you break an egg, make an omelet, right? So we're arranging through a liquidator to make this great music available for anyone looking for merchandise to sell at flea markets. Would you believe full-length digitally recorded CD music collections available as low as $2.65 each in quantity? Tests in New Hampshire flea markets saw these CDs selling like hot cakes at $4.50, with many entrepreneurs cleaning up $200-$300 on a Saturday. For more information on that, check with Buys Inc., Box 184, Antrim NH 03440-0184, 603-588-2105 days, an answering machine at night—or fax 588-3205.

Tesla Symposium, July 21-24

It's in Colorado Springs and there'll be a bunch of hams there, just like last year. I was there and had a great time. I learned a lot and met some wonderfully interesting people. Even better, I bought a ton of great books—many of which I've been reviewing and recommending to you.

The Symposium is at the Sheraton Hotel South, in Colorado Springs. Give the Tesla Society a call for details: 719-475-0918. Say Wayne sent you. I told you all about this last year, you just didn't pay any attention. If you're interested in weird science, don't miss this one.

And if you find that the Symposium doesn't keep you busy both day and night, you could do worse than drive up to nearby Boulder in the evenings and enjoy the ragtime festival. That's what Sherry and I did every night last year. If we can make it this year, we'll be doing the same. Scott Kirby will be there performing. Say hello to him and be enchanted by his artistry. He's incredible. You'll also enjoy Frank French, another superb performer. Call 303-499-9150 for details.

If Sherry and I can make it all the way from New Hampshire, what's holding you back? Have some fun. And if you can't make it, at least say hello on 14.297 via KC2Q.

Bad Science

The current scientist put-downs of cold fusion remind me of the early days of radio. As you're aware, we started out with spark transmitters. Well, I've donated several early radio books to the Wireless Museum which say that voice could never be transmitted because damped waves could not be modulated. These were, of course, published well after Nicola Tesla had demonstrated voice transmissions. History is packed with such wrong-headed scientific pontifications.

Maybe you've read about the early scientific controversy over the existence of ether. Well, light waves and radio waves had to travel through some kind of a medium, right? Just as sound waves travel through air. But when no one was able to detect the ether, they dismissed it, and moved light through space in photon packets. I guess radio goes in RF packets? Well, somehow it gets there, as do waves of a wide variety of other wavelengths.

So do magnetism and gravity. Gravitrons? So now some scientists are re-looking at the ether concept. Maybe "space" isn't nothing after all. And I don't mean the few atoms or molecules of stuff that's floating around out in "empty space."

Are the researchers who are generating "excess" energy somehow tapping into the ether? Well, there are a growing number of scientists who are starting to think more seriously about this. They're calling it "zero point" energy. Everything has to have a name.

Perhaps the mysterious excess energy cold fusion researchers are tapping can be explained in this way. Or maybe there are two possible electron orbits for hydrogen and the excess energy is resulting from changing this orbit. Or who knows?

We know a lot about electricity now. We can measure it, generate it, transport it, store it, and use it. About the only thing we don't know yet is what it is. We can measure gravity, but we don't know much more about it. We don't even know for sure how fast a "gravity wave" propagates. Speed of light? Instantaneous? We can measure inertia, but what causes it?

So don't tell me about how far along we are in science. And don't tell me what is or isn't possible. And that goes for our most revered and lettered scientists.

I'm hoping that *Nova* will broadcast either the March BBC or the April CBC documentaries on cold fusion. These programs have embarrassed the hell out of some very important scientists, making them look like idiots. I enjoyed the juxtaposition of the Department of Energy head saying cold fusion is the fiasco of the century against Dr. Fleischmann holding a reactor a little larger than a thermos bottle in his hands which he claims has been generating over 20,000 watts of power continuously. We could use a few more such fiascos.

The AMA Sucks

When I read about one therapy after another which has been proven in practice, but of which the AMA "doesn't approve," I almost get angry. It seems like almost every branch of science has the same problem.

In recent months I've learned a bunch about the problems that dental amalgam and nickel inlays can cause. If you have any amalgam fillings, I guarantee you'll be healthier if you get 'em replaced. You want to read *It's All In Your Head* by Hal Huggins. Those fillings, which the ADA still supports, are dumping poisonous silver and mercury into your body.

Then there's the way we're doing a job on ourselves by preventing ultraviolet light from getting into our eyeballs. Read *Health And Light* by John Ott, *Light, Medicine of the Future*, by Jacob Liberman, and *Into The Light* by W.C. Douglass. It's incredible what even just a little ultraviolet light can do for your health.

There also is a long history of curing a wide variety of illnesses by exposing a small amount of a person's blood to ultraviolet light and then putting it back. Illnesses like cancer.

Are low-powered magnetic fields helping to make you and your family sick? You bet they are. You can read more about this in *The Body Electric* by Robert Becker, *Cross Currents*, also by Becker, *The Electricity Around You May Be Hazardous To Your Health* by Ellen Sugarman, *Currents of Death* by Paul Brodeur, and *The Great Power-Line Cover-Up*, also by Brodeur.

You'll also want to read *Magnetism and Its Effects on the Living System* by Davis & Rawls.

And if that isn't enough, you're going to love *Hydrogen Peroxide Medical Miracle* by William Douglass. If you know anyone with cancer, colds, flu, artery plaque, heart disease, shingles, gum disease, etc., you should get them to read the book.

K4VSC sent me a brochure from the Jungle Aviation and Radio Service (JAARS) about a snakebite zapper. It does about the same as zapping a snakebite with a wire from the spark plug of a car or boat, the way the Peruvian Indians do. JAARS is making small hand-operated generators for jungle use (no batteries to die). They claim that the treatment also works on scorpion stings. I'd say we need more research. I'll bet a similar approach would work on jellyfish, stingray, scorpion fish, and fire coral stings. It might work fine for bee and wasp stings, and even mosquitos and other insect bites. Imagine what a business you could have with a little gadget which instantly stopped the itching of bug bites. It would have a small ring you'd put around the bite and an electrode to touch the middle of the bite. Zap, and no more pain.

There are more than a few reasons to suspect that something like this might also help with some skin or breast cancers. I've a letter from a reader citing the Swedish use of 12 volts to get rid of breast cancers.

Alas, there is very little funding available for research into non-pharmeceutical approaches to sickness repair, and it has been claimed by many people in the field that the FDA is controlled by the pharmeceutical industry. Tough combo to fight, no matter how good the therapy.

Now we read that in the last 50 years male sperm counts have been cut in half. What we haven't yet read is what whatever is doing this is also doing to the surviving half of our sperm. If whatever it is is killing half, imagine how sick or damaged the other half must be! Pesticides are suspected. They've been used so extravagantly that now they're into just about everything we eat and much of what we drink. They're into our farm lands and our water supplies. We eat them, drink them, and breathe them.

So what can we do about this mess we've gotten ourselves into? You can do the same thing I'm doing. You can read and get the facts. You can give talks at your local Chambers of Commerce, Rotary, Lions clubs. You can get on talk radio and pass the word. You can raise hell and put a brick under it.

I'm not talking ecoscams with little or no scientific basis like the ridiculous Alar scare, the owls, nuclear winter, acid rain, greenhouse summer, the snail darter, or the blessed ozone hole. And by the way, there are some fine books on all these media-hyped scares. The two I recommend as the best are *Evironmental Overkill* by Dixie Lee Ray, and *Ecoscam* by Ronald Bailey.

Your alternative is to keep quiet and shrug off your responsibility to do your best to fight for a healthier life for your children . . . and theirs. And, as you are shrugging, try to remember that the main reason democracy has failed so disasterously in America is the refusal of most people to assume any responsibility, thus leaving much of the change in the hands of nut cases who do go out and scream and carry on.

The bottom line: Do your homework and then make yourself heard.

Number 25 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check ***Special Events File Area #11*** *on our BBS* ***(603-924-9343)****, for listings that were too late to get into publication.*

AUG 1

DOYLESTOWN, PA The Wyndmoor AR Rptr. Club of Doylestown will meet at the Doylestown Twnshp. Bldg. Comm. Room on Wells Rd., at 7:30 PM. Interested persons may call *Bob Agans, (215) 348-7966*. The Club features speakers and videotapes on topics concerning amateur radio. They also get together for license tests and weekend excursions.

AUG 1-30

PITTSBURGH, PA For details regarding a Hamfest/Computer Show/Flea Market, contact *Catherine Crnhovich, Queen Roberta College, 3343 Webster Ave., Pittsburgh PA 15219.*

AUG 5-7

VERNON, BC, CANADA The 3rd annual Sky High Hamfest will be held by the North Okanagan RAC, at Silver Star Mt. Resort. Flea Market. Dinner & Dance. HF Station. More. Contact *North Okanagan ARC, P.O. Box 1706, Vernon BC V1T 8C3, Canada.* For hotel reservations, call *1-800-663-4431.*

AUG 6

CARLINVILLE, IL The Macoupin County ARC, Inc., will hold "Hamfest '94" at the Macoupin County Fairgrounds, 1/2 mile north of Carlinville, on Route 4. Doors open at 8 AM. VE Exams, all classes, pre-registration required. Talk-in on 146.82 and 443.400 (103.5 PL). For registration and info, call *(217) 854-8261.*

GOSHEN, IN The Elkhart County Hamfest will be held at the 4-H Fair Grounds located on CR 34. Talk-in on 145.430(-), 224.90(-), 443.325(+), PL 131.8. VE Exams. Contact *Jocelyne WZ9M, 20284 CR 36, Goshen IN 46526. Tel. (219) 533-7632.*

INDIANAPOLIS, IN The annual WA9SNT Hamfest will be held at ITT Tech. Inst., 9511 Angola Ct., from 8 AM-3 PM. Set-up at 6 AM. This event is sponsored by the ITT Radio Club. Talk-in on 145.25(-). Contact *Dave Johnston K9HDQ, (317) 875-8640.*

VALPARAISO, IN The Porter County Hamfest/Computer Show, sponsored by the Porter County ARC in co-operation with The Porter County Tourism Bureau, will be held at Porter County Expo Center. Doors open at 8 AM (set-up at 6 AM). VE Exams 9 AM-12 Noon. Talk-in on 146.775/-6kc 131.8 PL and 146.520 simplex. Contact *Rich N9QLQ, (219) 762-8701;* or send SASE to *PCARC HamFest, P.O. Box 1782, Valparaiso IN 46384-1782.*

AUG 7

CROOKED LAKE, ANGOLA, IN The Annual Land of Lakes Angola Hamfest, sponsored by the Land of Lakes ARC, will be held 6 AM-2 PM at Steuben County 4-H Fairgrounds, corner of 200W & 200 N. VE Exams for all classes. Talk-in on 147.180, 145.090 packet, 444.350 131.8 tone, 444.900/.100, 224.94, 53.050. Contact *Sharon Brown WD9DSP, 905 W. Pkwy. Dr., Pleasant Lake IN 46779. Tel. (219) 475-5897.*

MARSHFIELD, WI The Marshfield Area ARS will hold their 3rd annual Picnic, in Wildwood Pk., beginning around 11 AM. This is a Potluck/Swapfest. Talk-in on 147.180. Contact *Guy A. Boucher KB9GPJ, 107 West Third St., Marshfield WI 54449. Tel. (715) 384-4323. PACKETT:KB9GPJ @ W9IHW.WI.USA.NA.*

NEW KENSINGTON, PA The Skyview Radio Soc. will sponsor its annual Swap-n-Shop Hamfest from 8 AM-3 PM at the Club grounds on Turkey Ridge Rd. Talk-in on 146.64-. Contact *Michael Peltz N3MRU, 11 Manorfield Dr., Delmont PA 15626. Tel. (412) 468-8699.*

PEOTONE, IL The 60th annual Hamfest/Computer Festival, sponsored by Hamfesters RC, Inc., will be held at Will County Fairgrounds 6 AM-3 PM. Flea Market. Set-up Sat. Aug. 6th at 6 PM-12 midnight. Talk-in on 146.52 simplex, 146.64(-) (courtesy of STARS); 146.94 (-) (courtesy of KARS). For info, call *(708) 535-AHAM.* For advance tickets, send SASE and check by July 20th to *David F. Brasel NF9N, 6933 W. 110 St., Worth IL 60482. Tel. (708) 448-0580.*

UPPER MARLBORO, MD The 4th annual Southern Patuxent Hamfest will be held from 7 AM-2 PM at the Show Place Arena. Set-up from noon to 8 PM on Sat., Aug. 6th. Talk-in on 147.150(+). Contact *SPARC Hamfest, P.O. Box 399, St. Leonard MD 20685. Tel. (410) 586-2177.* Sponsored by The Southern Patuxent ARC.

WELLESLEY, MA The Wellesley ARS and the Babson Wireless Club will co-sponsor a Ham Flea Market from 9 AM-2 PM at Trim Hall, Babson College. VE Exams at 11:30 AM (register by 11 AM). Bring exam fee of $5.75 (checks made out to ARRL/VEC), an original and a copy of your license, an original and a copy of any CSCEs held, a calculator and a pen. To reserve tables, contact *Barbara Holdridge N1ICQ, 107 Church St., Westwood MA 02090. Tel. (617) 329-2628.* VE Exams Contact: *Gerry Driscoll NV1T, 107 Church St., Westwood MA 02090. Tel. (617) 444-2686.*

AUG 13

QUINCY, IL The Western IL ARC will hold the 1st Post-Flood Ham Radio/Computer Swapfest at Eagles Alps Lodge, 3737 N. 5th St. VE Exams (NA9Q-Reservations *(217) 224-8526).* Talk-in on 146.63/.03. For info, contact *Rod Simon N9MCX, c/o WIARC, P.O. Box 3132, Quincy IL 62305-3132. Tel. (217) 223-8739.*

TACOMA, WA The Radio Club of Tacoma will have its annual Flea Market at Charles Wright Academy, 7723 Cham-

bers Creek Rd. W., from 9 AM-3 PM. VE Exams at 10 AM. Commercial and non-commercial venders MUST pre-register for tables. Talk-in on 148.28. Contact *Alan Allen N7EAY, P.O. Box 11188, Tacoma, WA 98411. Tel. (206) 475-7413.*

AUG 13-14

CHARLOTTE, VT The BARC 42nd Internat'l Hamfest will be held by the Burlington ARC at The Old Lantern campgrounds on Greenbush Rd. Talk-in on 146.61/.01, 146.94/.34, and simplex 146.52. Flea Market. VE Exams. Demonstrations. Contact *Duane Waller N1BBR, (802) 877-2819.*

SHREVEPORT, LA The Shreveport ARA "ARK-LA-TEX" Hamfest will be held at Bossier City Civic Center, Benton Rd., Bossier City LA. Time: Sat. 8:30 AM-4:30 PM; Sun. 8:30 AM-1 PM. VE Exams. Forums. Banquet. Talk-in on 147.03. Contact *Alice B. Prudhomme KG5ZZ, Rt. 1 Box 410, Mansfield LA 71052. Tel. (318) 872-5988 after 6 PM.*

AUG 14

CHARLOTTE, NC Roll-A-Round Skate Center, 8830 East Harris Blvd., will be the location for the Charlotte ARC Hamfest/Computer Fair. Time: 8 AM-4 PM. Flea Market spaces are limited and must be pre-registered. Talk-in on 147.06(-), 444.85(+).For more info, call *(704) 522-4971, Ext. 3330.* Make checks payable to *Charlotte ARC,* and send with SASE (before Aug. 1st) to *Charlotte ARC, P.O. Box 33582, Charlotte NC 28233-3582.*

EASTON, PA The Delaware-Lehigh ARC, Inc. will hold its annual Hamfest/Computer event at the Career Inst. of Tech., 5335 Kesslersville Rd., starting at 8 AM. Set-up at 6 AM. Talk-in will be on 146.10/.70 MHz, W3OK Rptr. Contact *Bill Goodman K3ANS, (610) 253-2745 or (610) 258-5060.* You may also call the *DLARC answering service at (610) 820-9110.*

NAZARETH, PA A Hamfest/Computer Show will be held by the Delaware-Lehigh ARC, Inc. at the Career Institute of Tech., Easton PA, starting at 8 AM. Set-up at 6 AM. VE Exams. Demo Ham Station. Electronics Test Bench, and more. Talk-in on 146.10/.70 W3OK Rptr. Contact *Bill Goodman K3ANS, (610) 253-2745 or (610) 258-5060.* Also call *DLARC Answering Service at (610) 820-9110.* Make checks payable to *Delaware-Lehigh ARC, Inc.,* and mail to *The Delaware-Lehigh ARC, Inc., RR 4 Greystone Bldg., Nazareth PA 18064-9211.*

AUG 20

ALBUQUERQUE, NM The Duke City Hamfest is scheduled to be held at the New Mexico Army Nat'l. Guard Armory, 600 Wyoming Blvd., N.E. Hours: 7 AM MDT-5 PM MDT. Set-up Aug. 19th after 6 PM. For details about VE Exams, please call *Bob Witter at (505) 292-3218.* Flea Market spaces by pre-registration only. For info call *KC5FT or KB5SF at (505) 821-2771.* Make checks payable to *The Duke City Hamfest,* and mail with SASE prior to Aug. 11th to *Duke City Hamfest, P.O. Box 6552, Albuquerque NM 87197-6552.* Talk-in on 147.10 (+600 kHz) with back up on 147.15 MHz (+600 kHz). No one under the age of 15 admitted without parent or guardian.

LONGVIEW, WA The Lower Columbia ARA will host their 3rd annual Ham Radio/Computer/Electronic Equip. Swap Meet from 9 AM-3 PM at Cowlitz County Fairgrounds. Set-up Aug. 19th 5 PM-9 PM; Aug. 20th, 6 AM-8:45 AM. Talk-in on 147.26(+) K7ZVV Rptr. For info, call *(206) 425-6076, (206) 425-9184, or (206) 425-1866.* Make checks payable to *LCARA,* and mail to *LCARA Swap Tables, P.O. Box 906, Longview WA 98632.*

AUG 20-21

HUNTSVILLE, AL The 1994 Huntsville Hamfest will be held at the Von Braun Civic Center. Doors open to the public at 9 AM on both days. Dealer Show/Flea Market. Tech. Forums. Banquets, and more. The nearby Huntsville Hilton Hotel is participating by offering special Hamfest rates. Talk-in by K4BFT on 146.34/.94 MHz. For info, call *(205) 534-7175,* or write to *Huntsville Hamfest, P.O. Box 12534, Huntsville AL 35815.*

AUG 21

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a Flea Market from 9 AM-2 PM at Albany and Main St. For details call *(617) 253-3776.* Mail advance reservations before Aug. 5th to *W1GSL, P.O. Box 82 MIT BR., Cambridge MA 02139.* Talk-in on 146.52 and 449.725/ 444.725 PL 2A W1XM Rptr.

MARYSVILLE, OH The 18th Annual HamFest of the Union County ARC will be held at the Union County Fairgrounds near Columbus OH. Radio equip./Computer products. Flea Market. Contact *Gene Moore N8YRF, 24461 Claibourne Rd., Marysville OH 43040. Tel. (513) 246-5943.*

AUG 26-28

SAN DIEGO, CA The 1994 ARRL Southwestern Div. Convention will be hosted by the San Diego AR Council, Inc. at the Town and Country Convention Center off of I-8 in San Diego. Times: Fri. 3 PM; Sat. 9 AM-4 PM; Sun. 9 AM-Noon. Harbor Dinner Cruise Fri. night. Banquet Sat. eve. featuring Steve Roberts N4VRE and Behemoth. VE Exams. There will also be an ARRL ceremony for Wouff Hong. Talk-in on 145.320 - 107.2 PL. For info call *(619) 278-4284.* To pre-register, contact *Bob Boehme, 10340 Everell Place, Santee CA 92071.*

AUG 27

BRIDGEWATER, NJ The Somerset County ARS Inc. will hold their annual Hamfest at the Somerset County 4H Center on Milltown Rd., just off of Route 202. Time: 8 AM-1 PM. Set-up at 6 AM. Talk-in on 448.175(-). Contact *Donna, or George N2RQH, (908) 369-4533.* Or write to *SCARS, P.O. Box 742, Manville NJ 08835.*

CHAFFEE, NY The Arcade Kiwanis will sponsor the Pioneer Radio Operators' Soc. 3rd annual Chaffee Hamfest/Computer Show from 7 AM-3 PM at Manion Pk. Talk-in on 145.390 and 444.175. Ad-

vance registration tickets $3 each (Flea Market set-up included). Make checks payable to *Mike Wrona, 139 Greenmeadow Dr., West Seneca NY 14224.* Please include an SASE.

CHANUTE, KS The Chanute Area ARC Hamfest will be held 9 AM-2 PM at the Nat'l Guard Armory, South Santa Fe St. VE Exams; registration at 9:30 AM. Testing at 10 AM. Bring originals and copies of license and all certificates, and a picture ID. Flea Market set-up 7 AM-9 AM. Talk-in on 146.745-. Contact *Paul N0NBD or Sarah N0TKO, Rt. 1, Box 208, Humboldt KS 66748. Tel. (316) 473-2873.*

RHINELANDER, WI The Northwoods ARC, ARES, Rhinelander and Tomahawk Rptr. Assns. will co-sponsor the Northwoods Swapfest. Doors open 8 AM-2 PM at Sugar Camp Town Hall, 13 miles north of Rhinelander, on Hwy. 17. VE Exams: Registration 10:30 AM, testing at 11 AM. Contact *Mary Berger NS9Q, 367 Lois St., Rhinelander WI 54501. Tel. (715) 362-9296.*

ROSEAU, MN Lake of the Woods Rptr. Assn., Inc. will hold their 8th annual Ham Fest at Roseau High School Gym, Hwy #11 E. VE Exams. Flea Market. Banquet with program. More. Talk-in on 147.69/.09 and 146.40/147.00. Contact *David Landby KB0HAP, Rte. 3, Box 10, Warroad MN 56763. Tel. (218) 386-1092.*

AUG 28

LEBANON, TN A Hamfest will be held at Cedars of Lebanon State Pk., U.S. Hwy. 231, 7 mi. south of I-40. The Short Mountain Rptr. Club will host this event 7 AM-3 PM. Talk-in on 146.91. Contact *Mary Alice Fanning KA4GSB, 4936 Danby Dr., Nashville TN 37211. Tel. (615) 832-3215.*

MATAMORAS, PA The ARRL sanctioned Tri-State ARC Hamfest will be held at Hunts Best Western Pavillion, RT. 84 Exit 11 (where PA, NY and NJ meet). Flea Market. ARRL Booth. Contact *Paul KD3L, (717) 491-4808 after 1 PM; Ray WY2D, (914) 856-1733 after 6 PM;* or *Bob N3NPT, (717) 296-4551.*

ST. CHARLES, MO The St. Charles ARC will host "Hamfest94" at the Blanchette Park from 6:30 AM-2:30 PM. Vendor area open 9 AM. Talk-in on 146.07/.67. Contact *Scott Schultz N0UVM, 241 Burning Leaf Dr., St. Peters MO 63376. Tel. (314) 928-7267.* To pre-register for VE Exams, call *(314) 524-3254.*

WOODSTOCK, IL The Tri-County Radio Group, Inc. will hold its Hamfest/Computer Show at the McHenry County Fairgrounds located just off Route 14 on Route 47, beginning at 6:30 AM for Fleamarket, and 8 AM for exhibitors. (Set-up Sat. by appointment, or 6:30 AM on Sun.) Talk-in on 146.52 simplex. Reservation deadline is Aug. 10th. Write to *T.C.R.G., P.O. Box 3107, Skokie IL 60076-6107;* or call *Robert N9KXG, (708) 658-1678.*

YONKERS, NY A Hamfest/Computerfest, sponsored by the Yonkers ARC, will be held 9 AM-3 PM at the Yonkers Municipal Parking Garage on Main St. Talk-in on 146.865, 440.150 MHz. Pre-registration is $10 per space. Make checks payable to the *Yonkers ARC* and send your order with an SASE to *Y.A.R.C., P.O. Box 378, Centuck Sta., Yonkers NY 10710-0378.*

SEPT 2-3

NEW ORLEANS, LA The New Orleans Internat'l DX Convention will be held at Royal Sonesta Hotel on Bourbon St. Times: Fri., Sept. 2, 1 PM-11 PM; Sat., Sept 3, 8 AM-Midnight. Registration deadline is Aug. 15th. For more info, call *(504) 283-4143 days only; FAX (504) 524-2129.* Send checks or money orders payable to: *New Orleans Internat'l DX Convention, c/o Michael Mayer W5ZPA, 5836 Marcia Ave., New Orleans LA 70124.*

SEPT 17

SCOTTSDALE, AZ The Family AR Event will hold its 2nd annual event at Rawhide Western Town, 23023 N. Scottsdale Rd. RC airplane demo. Weathersat forums. Emergency Ham Radio. Activities for children. Swap meet area opens at 6 AM. Exhibit hall opens at 9 AM. Contact *Len Winkler KB7LPW, P.O. Box 9219, Phoenix AZ 85068. Tel. (602) 861-0303.*

SPECIAL EVENT STATIONS

AUG 5-7

MACUNGIE, PA Local hams will operate W3TEB on the General 80, 40 and 20 meter phone subbands and 146.55, in conjunction with the 31st annual Das Awkscht Fescht (PA Dutch for "August Festival" - A Festival and Antique Car Show). For a certificate, send QSL and SASE to *Henry Buchin W3TEB, 21 East Main St., Macungie PA 18062-1308.*

AUG 6-7

BARNEGAT LIGHT, NJ The Old Barney ARC will operate W2OB from "OLD BARNEY," the Barnegat Lighthouse (Long Beach Is. IOTA NA-111), to commemorate Nat'l Lighthouse Day. Time: 3000 UTC-0000 UTC each day. Freq.: Look in the lower 25 kHz of the General phone bands; 40, 20, 15, and 10 meters, plus 146.52 simplex, 146.835 Rptr., and other local Rptrs. For a special QSL, send a 9" x 12" SASE with 2 units of postage, via NU2F. For more info, contact *QSL W2OB via NU2F, Joe Fleishinger Sr., 75 Joshua Dr., Manahawkin NJ 08050 USA.*

WELLSBORO, PA The Tioga County ARC will operate WO3C 1300Z Aug. 6-1800Z Aug 7, from Leonard Harrison State Pk, to celebrate the 50th Anniversary of Smokey Bear. Operation will be in the 80, 40, 20 and 15 meter General phone subbands, and in the Novice 10 meter phone subband. For a certificate, send QSL and a 9" x 12" SASE to *Darlene Rahn WO3C, R.D. #6 Box 200, Wellsboro PA 16901.*

AUG 7-13

POTTSVILLE, PA The Schuylkill ARA will operate N3ILC Aug. 7th-Aug. 13th, to celebrate the Schuylkill County Fair. Operation will be both CW and phone on the General and Novice subbands. For a certificate, send QSL and SASE to *Ed Brennan N3ILC, 520 Spring Garden St., Pottsville PA 17901-1651.*

AUG 12-13

MIDDLEBOURNE, WV The Tyler County ARO will operate KA8GOH 1500Z-2200Z Aug. 12th and 13th to celebrate the 32nd annual Tyler County Fair. Operation will be in the lower portion of the General 40 and 20 meter phone bands, and the 146.385/R. For a certificate, send QSL and 9" x 12" SASE to *TCARO, P.O. Box 287, Middlebourne WV 26149.*

AUG 12-16

WEST ISLAND, MONTREAL, CANADA Members of the West Island ARC are planning the club's 3rd expedition to St. Paul Island (off the northern tip of Nova Scotia). IOTA NA-94. The group plans to operate CW, SSB, and RTTY, using the call CY9CWI. Operation will be on 40, 80, and 160 meters. Operations will start at 0000Z on Aug. 12th and continue through Aug. 16th. Freq.: (MHz) 1.830-50, 3.505-15, 3.780-3.800, 7.040-7.060, 7.250, 10.110, 14.040, 14.195, 18.080, 18.120, 21.040, 21.320, 24.940, 28.120, 28.495, RS-12: Tx 21.220, Rx 29.420, RTTY 7.090, 14.090. Listen for operators Reg. VE2AYU, Coos. VE2GTI, Jean VE2JCX, Jean VE2TBH, Lowell VY2OX, Fred VE2SEI, Andrew VE2WHO, Helen VE2YAK, and Margaret VE2ZOO. VE2YAK and VE2ZOO will be especially looking for ops trying for YL DXCC. Address QSLs to *West Island ARC Inc., P.O. Box 884, Pointe-Claire/Dorval QC, Canada H9R 4Z6.* For more info, contact *Fred Archibald VE2SEI, 130 Embleton Cres., Pointe Claire QC, Canada H9R 3N2.*

AUG 13

BARNESBORO, PA The Dividing Ridge ARC will operate KE3DR 1500Z-2300Z to commemorate Barnesboro's Centennial. Operation will be in the lower General 40 and 20 meter phone subbands and the Novice phone portion on 10 meters. For a certificate, send QSL and SASE to *Dividing Ridge ARC, RD#1 Box 503-A, Barnesboro PA 15714.*

CENTERVILLE, GA The employees of Georgia Power Co. (Plant Scherer) and friends will operate Station AD4FC to commemorate the company's dedication to the environment and the community. The event will begin at 1200 UTC and end at 2400 UTC. Operation will be in the lower 25 kHz of 80, 40, 20, and 15 meter General class phone subbands, and in the 10 meter Novice class phone subband. For a certificate, send a 9" x 12" SASE to *Don Hall AD4FC, 262 Valencia Cir., Centerville GA 31028.* There will also be VE Exams and a Tailgate Swapfest.

LAKE WINNIPESAUKEE, NH The Central NH ARC will operate W1JY from the deck of the 235 ft. M/S Mt. Washington. Operation will be 1200Z-1900Z on 28,333, 21,333 and 14,333 +/- 3mh. Listen on 10 meters on the hour, 15 meters at 20 minutes after the hour, and 20 meters at 40 minutes after the hour. For a certificate, send 9" x 12" SASE and QSL to *CNHARC, Box 1112, Laconia NH 03247-1112.*

AUG 13-14

FALL RIVER, MA Station W1ACT will operate from aboard the tall ship "H.M.S. Bounty" as part of the annual "Fall River Celebrates America" Festival. Operations will be on 2, 6 and 10 through 160 meters, using CW, SSB, and FM. The Station will operate 1400Z Aug. 13th-1400Z Aug. 14th. To get a QSL card, please QSL via *Ed Walsh WV1L, 798 Second St., Fall River MA 02721.*

MILFORD, MI The Milford ARC will operate W8YDK 1500Z-2300Z both days, to celebrate the Milford Memories Summer Festival in commemoration of the discovery and founding of Milford MI. Operation will be in the lower portions of the General and Novice 40, 20 and 10 meter subbands. For a QSL card, send SASE and QSL to *Joe Kaminsky N8PGF, MARC, P.O. Box 301, Highland MI 48357.*

Number 27 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

ICOM

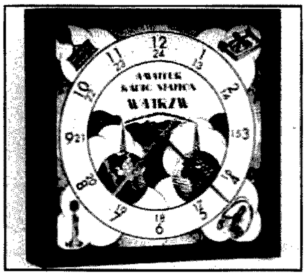
Icom has announced the IC-820H high performance all-mode dual-band base station transceiver for 2 meter and 440 MHz operation. The IC-820H is compact and lightweight, making it ideal for mobile, fixed, or field operation. Yet, this new transceiver is packed with top performance features, including a newly designed DDS capable of resolving 1 Hz tuning steps for fine-tuning.

Built-in satellite functions include normal and reverse tracking, independent uplink/downlink control for Doppler shift compensation and separate satellite VFO. Ten satellite memories allow you to quickly switch from normal to satellite operation.

Independent controls and indicators for each band make the IC-820H easy to operate. Additional features include IF shift, memory allocation, AF speech compressor, auto repeater and one-touch repeater, built-in high stability crystal unit, RIT, CW semi break-in, and side tone.

The suggested retail price is $1,999. For more information, visit your favorite dealer or contact *Icom America, Inc., 2380-116th Avenue N.E., Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

AMATEUR RADIO EXCELLENCE



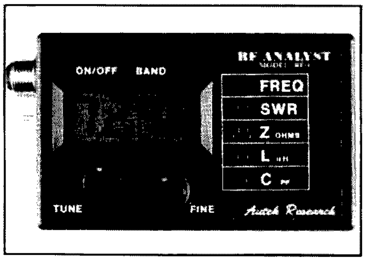
Amateur Radio Excellence Products has introduced the ARE "Classic" Clock for the ultimate ham shack. Ham operators everywhere will appreciate the Classic's beautiful, original artwork dial, capturing the essence of the Golden Age of radio. The classic represents the finest value available today in a custom-made clock for radio amateurs.

The ARE Classic features a 12- and 24-hour dial, quartz accuracy, and a fully laminated artwork face with the call letters of your choice custom-printed with the art. These beauties are 100% crafted in the USA. The clock frame measures approximately 9" square by 2" deep, and is suitable for desktop display or wall mounting.

The ARE Classic is powered by one AA battery (included), and is gift-boxed in fine tissue. The dial face is dark brown on light beige; frames are available in simulated light oak, walnut, or black (shown) finishes. Please specify frame and call letters when ordering.

The price is $39.99 plus $4.50 shipping in the USA. (Foreign addresses add shipping FPO NH, USA.) For more information or to order contact *Amateur Radio Excellence, P.O. Box 1551, Dept. 73, Manchester, NH 03105.*

AUTEK RESEARCH



Autek Research has introduced the pocket-sized RF Analyst, designed to check and adjust antennas, feedlines, and RF networks. It includes a microprocessor, A/D converters, and a low-distortion leveled sine wave generator with four-digit readout. This device is continuously adjustable from 1.2 to 35 MHz in five bands. Measurements include RF impedance (0 to 2,000 ohms), SWR (1 to 15:1), C (0 to 9,999 pF), and L (<.04 to 300 μH). This range of digital readout information is unique in this price range.

The instrument connects to any antenna or feedline for instant readouts. L and C are measured at the frequency of interest, showing the true RF value of these components. Basic accuracy is 2.5% to 5% over most of its range. The instrument fits into a shirt pocket and runs on a 9 volt battery.

The Autek Research RF Analyst is priced at $129.95 plus $6 S&H (US). For more information or to order contact *Autek Research, 4143 W. Waters Ave., #120, Tampa, FL 33614; (813) 871-3805.* Or circle Reader Service No. 205.

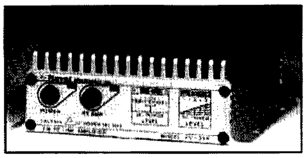
GORDON WEST RADIO SCHOOL

The amateur radio General Class Element 3B question pool has been revised as of July 1, 1994. The new question pool will be valid for four years, and will reflect the exact 288 questions and answers now found on amateur radio General Class tests. All of the Gordon West Radio School books and cassettes have been updated to coincide with this change.

"Only the General Class Element 3B question pool was changed last July," says Gordon West WB6NOA. "All other amateur radio question pools remain exactly the same, and the Advanced Class pool is next for revision in about nine months," adds West.

The new General Class audio cassettes also cover all the new General Class questions. They have been completely updated in stereo to make learning convenient and fun, whether while exercising at home or while driving in the car.

The updated books and cassettes are available at your favorite dealer, or you can order the autographed set direct for $19.95 plus $3 S&H. For more information or to order contact *Gordon West Radio School Inc., 2414 College Drive, Costa Mesa, CA 92626; (714) 549-5000 (Hot Line 10-4 p.m.); (714) 434-0666 (Info Line 24 hrs.).* Or circle Reader Service No. 202.

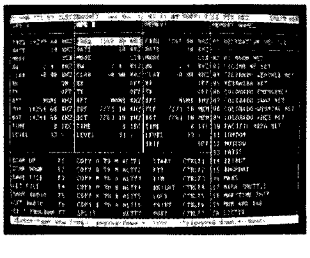


NAVAL ELECTRONICS, INC.

Naval Electronics has introduced their new all-mode PV-35R VHF Linear Amplifier incorporating a GaAsFET preamp as well as RF power and supply voltage indicators. The unit provides a maximum output of 35 watts (30 out for 3 in). LEDs show output levels of 10, 20, and 30 watts and, at the same time, power supply variations from 10.5 to 13.8 VDC. This amp works in the FM, CW, AM, and SSB modes.

For more information contact *Naval Electronics, Inc., 5417 Jetview Circle, Tampa, FL 33634; (813) 885-6091, FAX (813) 885-3789.* Or circle Reader Service No. 203.

ELECTROSOFT

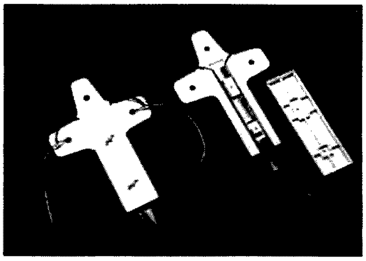


Electrosoft has introduced a program to control the Yaesu FT-990 transceiver. The program works on any PC or compatible equipped with a serial port and requires the FIF-232c interface circuit supplied by Yaesu.

The Electrosoft program reads the frequency, bandwidth, and mode for both VFOs and for 90 memory channels, then stores the data in a computer file. You can store an unlimited number of channel files. The program can read any previously saved file and reset the frequencies, bandwidths, modes, and scanning information quickly and easily.

The bottom line on the screen shows the command keys used to edit and the highlighted fields in the four top windows. The program is backed by a money back guarantee and is priced at $100. For more information or to order contact *Electrosoft, P.O. Box 1462, Loveland, CO 80539.* Or circle Reader Service No. 204.

WA1FFL



Wire antenna enthusiasts will be interested in a new center support device, the WA1FFL Ladder-Loc for 450 ohm ladder-line antennas. The device is constructed of calcium-reinforced polypropylene and features a built-in strain relief to take the weight off the wire joints at the feed point. It has overlapped construction to keep water out of the sides and is very sturdy.

The Ladder-Loc goes together quickly with two wing nuts; adding a touch of sealant will make it completely weatherproof. The product is priced at $11.95 plus shipping. For more information or to order contact *Radioware, P.O. Box 1478, Westford, MA 01886; (800) 950-9273.* Or circle Reader Service Number 206.

RANDOM OUTPUT

Number 28 on your Feedback card

David Cassidy N1GPH

Another Ham Scam

The history of amateur radio has been *frequently* marked with people trying to make a buck. I'm not talking about legitimate businesses that sell products or services to the ham community. I'm talking about the periodic attempt by some less-than-legitimate characters to take advantage of hams. The most recent to come to my attention is interesting only because of who is behind it.

I received a fax from an amateur in Texas that contained the contents of a mailing he received from The W5YI Group. The outside envelope was enblazoned with all kinds of large and alarming messages like "Urgent Alert!" and "Your Amateur Radio License Is About To Expire!" Inside was a Form 610 with the instructions removed, a separate sheet of instructions and a letter/order form warning of the eminent expiration of the recipient's amateur radio license. Fred Maia W5YI explains in this letter that he is such a nice guy that he just thought he'd remind you of the upcoming expiration of your license and give you the chance to renew it through his company for a measly $5.

Wait a minute. I thought there was no fee involved with an amateur radio license. Oh, I see. Buried within the instruction sheet that comes in the mailing is the notice that "The FCC does not charge a fee to renew your license. The $5.00 fee is to reimburse The W5YI Group for the administrative costs involved in operating a notification and renewal service." The instructions then go on to mimic the FCC instructions that somehow became separated from the 610 before being inserted into the envelope, and conclude with a large and boldfaced reminder to "Return this letter, FCC Form 610 application, and copy of your license along with the $5.00 fee in the enclosed envelope today!"

As the skunk said, "Is it me, or is it starting to stink in here?"

When you consider the average age of an amateur radio operator and realize that many of these packages will be received by elderly people, it is more than deplorable. If you are about to write me a letter about how the above-quoted disclaimer makes it all OK, save it. I don't care how many carefully-worded phrases The W5YI Group puts into the letter, the purpose of this package is to get $5 from as many hams as possible. The W5YI Group is a business, and like any business they have the right to make a fair profit from their efforts. This particular effort is sleazy. How many elderly hams will receive this package and send out the $5, thinking they narrowly escaped losing something that brings joy and companionship into their lives? Fred, you should be ashamed of yourself.

Is this $5 license renewal scheme *illegal*? No, probably *not*. After all, that disclaimer *is* in there. It's enough to save any investigation from the bunko squad. There is a very large difference between what is legal and what is moral. What is legal is defined by law. What is moral is defined by your own heart. We all have to make our own decision as to what defines our values and ethics. We all decide what our integrity and character are worth. Is the integrity of The W5YI Group worth about five bucks?

If you are confused as to how to complete an FCC Form 610, ask for help from someone on your local repeater or at your next ham club meeting. If you are friends with a ham who might be taken in by this kind of a scheme, ask them when their license expires and help them to get it renewed. If they can't produce a copy of their license and don't know when it expires, help them to find out.

When obtained from a legitimate source, the FCC Form 610 includes sufficient instructions to renew your license. Anyone who could manage to pass an amateur radio exam (or, for that matter, anyone who had enough brains to figure out how to obtain a license *without* taking the test) can certainly figure out how to write their own name and address and check the appropriate boxes. One thing the FCC Form 610 also includes that somehow was omitted from The W5YI Group's package is the address of the FCC, which is the only place any of you need to be sending a license renewal. 73

"When obtained from a legitimate source, the FCC Form 610 includes sufficient instructions to renew your license."

PROPAGATION

Number 29 on your Feedback card

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

August has middle-of-summer type propagation conditions, and you can't expect a particularly good month for HF DX. The Solar Flux continues to decline and the usual summer "blahs" are upon us, along with hot weather throughout most of the Northern Hemisphere.

The *worst* days are expected to occur on the 1st, 12th-14th, and again on the 28th-31st. The *best* days are expected to be 5th-8th, and 18th-24th. Other days, as indicated, will be Fair or trending between Fair and Good or Poor. It looks like we may expect some severe geophysical conditions surrounding the 28th for a day or two either way. The 1st will see us emerging from some severe conditions on or near the last two days of July. As you know from following these reports over the years, we can miss by a day or two from the predicted dates in either direction, but be particularly alert on the first few and last few days of the month, keeping an ear tuned to WWV and to your local weather stations.

10 and 12 Meter Bands

Sporadic E during daylight hours on many Good days (G), with strong skip signals from 500 to 1,500 miles, and with abrupt termination of contact as the ion cloud moves out of range.

15 and 17 Meter Bands

Good sporadic E contacts between 300 and 1,300 miles on most Good (G) days. Also, you may find trans-equatorial skip into the Southern Hemisphere, with decent but not outstanding signal strength.

20 Meter Band

Consistent DX to most parts of the world on Good (G) days during daylight hours, and on particularly favorable days, often until midnight local time. This band will be your DX workhorse.

30 and 40 Meter Bands

Nighttime DX between local sunset and sunrise ought to be good-to-excellent on days marked Good (G) on the chart, and often on Fair (F) days. Thunderstorm activity usually abates several hours after sunset, but QRN will obscure weak signals. Day and night short skip will occur on many days, with daytime skip averaging up to 1,000 miles and nighttime skip up to 2,000 miles. Beware of high absorption levels around local noon.

80 and 160 Meter Bands

Forget any daytime activity, but when conditions are Good (G) you may well discover occasional DX at night, especially when QRN from thunderstorms isn't present. There will be few, if any, really good DX contacts on 160 or 80 during July. Short skip at night, however, can be pretty good out to about 1,000 miles or so.

Always listen to WWV and the propagation forecasts at 18 minutes after any hour, when up-to-date reports of Boulder K and A indexes are given along with solar flux readings. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
AGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40'	40		15	15	15	10	10
ENGLAND			40*	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40'	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40'	40		15	15	15	10	10
SOUTH AFRICA			40	40		20	20				20	
U.S.S.R.							20	20		20		
WESTCOAST	20	40	40	40'	40'	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40'	40		20			20	
CANAL ZONE	15	20	20	20	40'	40	20	20	15	15	15*	10
ENGLAND	20	40					20	20		20	20	20*
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40'	40	20	20	15	15	15*	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40'	40	20	20	15	15	15*	10
SOUTH AFRICA							20				20	20
U.S.S.R.								20			20	

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40'	40'		20		15	15
CANAL ZONE	15	15	20	20'	40'	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20'	40'	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20'	40'	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20'	40'	40		20	20	15	15	15
SOUTH AFRICA			40						20			
U.S.S.R.									20			
EAST COAST	20	40	40	40'	40'	40						20

1 = Possible 80 meter openings * = Check next higher band G - Good F - Fair P - Poor

AUGUST 1994

SUN	MON	TUE	WED	THU	FRI	SAT
	1 P	2 P-F	3 F	4 F-G	5 G	6 G
7 G	8 G-F	9 F	10 F-P	11 F-P	12 P	13 P
14 P	15 P-F	16 F	17 F-G	18 G	19 G	20 G
21 G	22 G	23 G	24 G	25 G-F	26 F	27 F-P
28 P	29 P	30 P	31 P			

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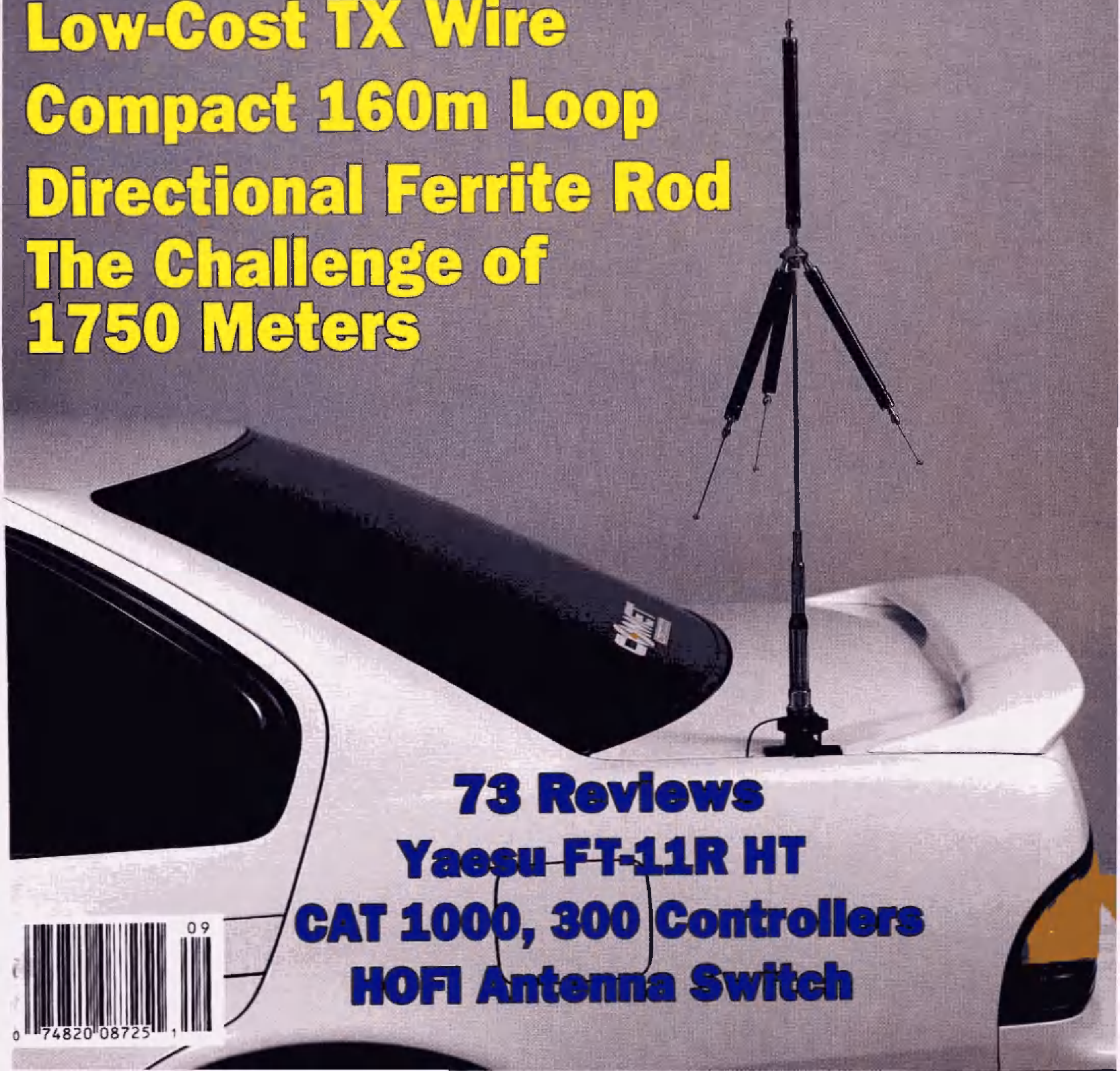
Directional Ferrite Rod
The Challenge of 1750 Meters



73 Reviews

Yaesu FT-11R HT
CAT 1000, 300 Controllers
HOFI Antenna Switch

0 74820 08725 1 09

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September 1994
Issue #408

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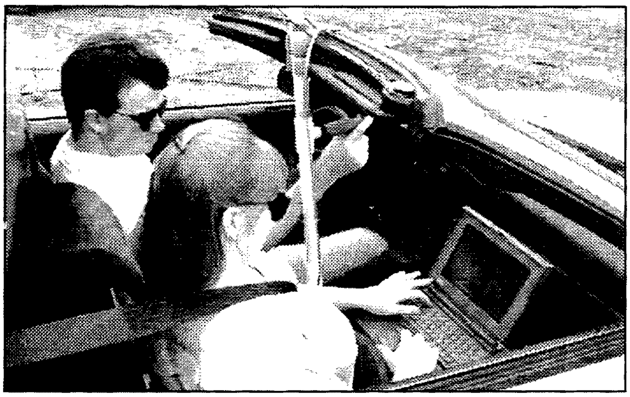

"Where the heck are we going?" Turn to "Homing In" on page 56 to find out.

DEPARTMENTS

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: The new Comet HA-4S Mobile HF Antenna (photo by Wayne Holden). Read about it in "New Products," page 80.

FB

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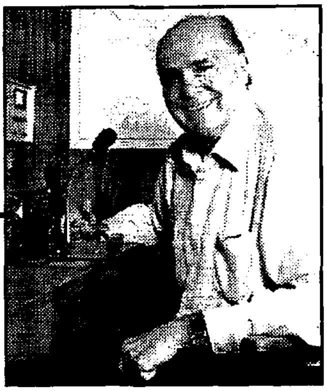
Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



Retrospective

With the 35th year of *73* starting next month, it almost got me to thinking. Back in 1960, when I started the magazine I never would have guessed that I'd still be at it over 30 years later. I wasn't really thinking a lot about the future then. I just knew that the magazine was needed, so I went ahead and started it. *CQ* was mostly columns and contests; *QST* was club news. Builders needed a magazine.

I'd been editing *CQ* for five years before that and believed that hams wanted a magazine devoted to home construction. Having just been fired by *CQ*'s publisher, who wanted to just run monthly columns because it was cheaper, I sold everything I could . . . my boat, my plane, and even my little Porsche Speedster, and rounded up enough money to print the first issue of *73*. It was an enormous gamble, and I had no backup in case it didn't fly. It was a one-man operation, with me hustling subscriptions at hamfests, bending arms for articles, calling prospective advertisers, typing subscriber stencils, editing articles, cajoling columnists, and so on.

The worst time was in 1964, when the ARRL's so-called Incentive Licensing proposal to the FCC stopped the growth of the hobby dead for several years. Within a year the over-850 ham stores selling *73* had fallen to around a hundred, with the rest being forced out of business by tens of thousands of hams selling their equipment at fire-sale prices in panic over the ARRL's proposed new rules. This was when over 90% of the ham manufacturers went out of business, too. The mainstays such as Hallicrafters, Hammarlund, National, Johnson, Multi-Elmac, Gonset, Millen, Stancore, Thordarson, and so on disappeared.

When I latched onto 2m and repeaters in 1969 as a way to build interest, at first the readers hated it. Then, gradually, they found FM was fun and suddenly there was a new $100 million ham industry. It was this success, which only *73* promoted, and which we know today commercially as cellular telephones, that gave me the idea for plunging into computers in 1975, when the first microcomputer was introduced by one of my *advertisers*, MITS, in Albuquerque. That triggered the starting of *Byte, Kilobaud, Microcomputing, 80 Micro, Desktop Computing, InCider, Run,* and so on.

Eventually microcomputers challenged mainframes and minicomputers. In 1964 Gordon Moore, one of the founders of Fairchild Semiconductor, and later Intel, predicted that computer chips would get 30% cheaper every year, and that the number of transistors that could be built on a silicon chip would double every 18 months. These are known as Moore's Laws, and they are still valid 30 years later.

By 1983, eight years into the microcomputer revolution, I'd watched the industry grow at a steady rate of 235% a year. My own publishing mini-empire was growing at 100% a year. I joked that whenever there seemed like a possibility that we might be about to make a profit I'd start a new magazine and take care of that emergency. We were always operating right on the edge. Credit rating? When I decided to try and buy a house I couldn't find a bank that would give me a mortgage. I didn't care much, I was happy with using two rooms of my 40-room publishing house for a small apartment. But Sherry wanted a house. You know how women are. The nesting instinct, and all.

When it became obvious that no matter how much microcomputers were dismissed by the computer industry, they were going to win, I began to get overtures to buy my publishing company. I had the largest collection of magazines in the field, plus a healthy book publishing business, and a software company with over 250 titles. I also had around 220 employees, and every available building in town. I even bought the local motel and turned it into 26 nice offices, each with a shower. The restaurant was converted into a computer lab with 30 microcomputer development stations.

Bill Ziff of Ziff-Davis was bidding, as was Pat McGovern of IDG (*Computerworld*) Prentice-Hall, and others. A British group even flew me to London on the Concorde to see their operation. Though Prentice-Hall had the highest bid, once I met with their golf-club-oriented executives, I knew that wasn't what I wanted. I opted for IDG. I knew I had little choice as far as selling was concerned. The megapublishers wanted in, so it was either sell out for the best deal I could or get crunched. My fellow publishers who refused to sell were blown away.

When I sold my mini-publishing empire, my production and circulation facilities and everything else went with it. Sure, I was promised any services I wanted to start new magazinces, but the minute I asked for them, they were unavailable. I found I would have to start all over and build a new publishing organization. Without the publishing support services there was no way I could continue to publish *73*, so even though IDG didn't want to be bothered with a crummy little ham radio magazine, they took it.

Unfortunately they handled *73* the same way they did my six other magazines, putting corporate bumblers in charge. Within a couple years *73*'s ad sales and circulation had been cut in half. It was even worse with my computer magazines. *80 Micro*, which had been running over 600 pages a month and was the third largest magazine in the country, quickly sickened and died. *InCider* (for the Apple), which had been zooming, was soon almost wiped out by Ziff's *A+*. *Microcomputing*, which I'd started in 1976 and had been a steady profit-maker for seven years, was repositioned and died almost immediately. And so it went with *Hot Coco* for the Tandy Color Computer, *Desktop Computing*, the first non-technical computer magazine for businessmen, *Selling Micros*, a magazine for computer retailers, and so on. *Run*, for the Commodore, gasped on for a few years.

Meanwhile I started from scratch, buying a building in North Peterborough where I started *CD Review*. I knew that compact discs would quickly replace LPs, and I also knew that around 99% of the new CDs issued would be disappointing, so I figured that there was a need for a magazine rating new CD releases. I was right.

I had to buy new typesetting equipment. I went with the state-of-the-art Bedford system. It was expensive, costing nearly $1 million by the time we got through. They had only delivered part of the equipment when Bedford went into Chapter 11. We never got the rest of the equipment, or any money back. When we outgrew the Peterborough building I bought an old factory building in the next town, Hancock, and just about rebuilt it. New roof, new walls with insulation, and we divided it into offices.

CD Review soon became the leading music review magazine in the country, with over 200,000 readers and some fabulous success stories from advertisers. Reader surveys showed that our readers were spending over $250 million a month on compact discs.

It was along about this time that IDG got fed up with losing money on *73* and offered to sell it back to me. We finally struck a deal where I'd publish it for IDG on contract, and this continued until a couple years ago when IDG made an offer for *CD Review* that I couldn't refuse. Part of the deal was me getting back the ownership of *73*. Taking back *73* was a challenge. IDG had lost half the readers and angered most of the advertisers. I picked a new team to handle it and charged them to be first with reviews of new ham gear, to publish a ton of antenna articles, and to find all of the simple construction projects they could. Also, I wanted them to try and cover as many of the sub-hobbies which make up amateur radio as we could. Plus I started writing editorials again.

It's been a slow climb back, but we've been gaining readers steadily. Before *73* did its nose dive it had had the most advertising of any of the ham magazines, plus the highest ad rates. How did we get away with that? The *73* readers were buying more stuff by a wide margin than the readers of the other magazines. We had a lock on the active hams, with *QST* being more of interest to retired hams who wanted "to support the League." We did a *QST* reader survey and found that 70% of the subscribers never even looked at the ads in the front of the magazine, and 50% didn't bother going through what is essentially a catalog section in the back. With half their readers uninterested in the advertising and not even bothering to look at it, it was no wonder the *73* readers were buying so much more ham gear.

The Music Business

Two things got me into the music business. Two things besides publishing a music review magazine, that is. I've always loved music, so I was having a ball helping to review new CD releases. My specialties were classical, country, and ragtime.

When *I heard* Scott Joplin's music in *The Sting*, I wondered how I'd managed to miss something so wonderful. I bought every LP of Joplin's music I could find and played them night and day for months. I got so I knew every note of everything known of Joplin's. But the more I listened, the more I felt that none of the performers really understood what Joplin had written. None of them were doing it right.

While attending a music business

Continued on page 74

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Bill Burden WB1BRE, Strafford VT Wayne, I was talking with the Police Amateur Radio Team (PART) people down in Westford, Massachusetts, recently. They monitor 146.52 24 hours per day, covering parts of Rte. 3 South and 495 West, so that hams can call emergencies directly in to the police station. The information is then relayed immediately to the appropriate service via the police communications system.

It has been interesting to watch the dramatic change in the number of calls handled through PART since the advent of cellular telephones. When this service was started many years ago, almost all emergencies were called in through the PART system. Recently, the drop in calls has been significant and is putting the amateur radio resource into a marginal value situation.

I have been here in Vermont for over two years now and have been able to monitor emergency communications activities on several occasions where amateur nets were activated for support. My strongest impression has been one of amateurs talking to other amateurs with little or no contact with the operating agencies. I finally found out why! It seems that here in little Vermont they have installed a statewide microwave system with 200-300 channel capability and agency intercommunication is a standard thing. Further, the sites and system have been "hardened" to survive the harsh weather, loss of power, etc., so that the state communications system functions well in all conditions.

One rumor I got from the activities surrounding the latest Los Angeles earthquake was that many cellular phone systems survived and operated well and that one of the telephone BBSs was handling large-volume health and welfare traffic for the area.

Recent discussions among some of us here in New England support the notion that our role in emergency communications is changing. While we will still need the capability to provide support in some extraordinary circumstances, much of the work we used to do is handled on a more routine basis by the serving agencies now. They have put more money into developing sophisticated and "hardened" systems. In some ways, we may be victims of having done a good job of convincing these people, by word and example, of the value of a good emergency communications system. We are finding that we need to form more alliances with groups that, for reason of cost or skills, simply do not have good emergency support communications. A clear example is the American Red Cross. Our relationship is very good and we can provide a valuable service in setting up communications networks between shelters. The Skywarn program promises to put amateur radio in a position to be a vital resource in times of weather emergency.

There is no question in my mind that our role in emergency communications is changing and we need to think about our future and seek new and innovative ways to utilize our skills in emergency work so we don't find ourselves on the outside looking in.

Phillip Kawa KA1WJQ, Weymouth MA Wayne, I have never heard of any of your code tapes but your editorial described a "process of elimination method" which is certainly a logical approach to learning code because the human mind wants to be logical. Very good, but not a major breakthrough; however, I would like to hear one of your tapes.

Now "MY Method" (which you fault me for keeping a secret although it's been advertised in *73* and *Radio Fun* for the last three years, is manufactured by IMPS, and is the only code tape *ever* to get air play on commercial radio and Dayton TV 6 o'clock news channel 22) uses a simple rhythm method for character recognition and it is better measured in "beats per minute" then characters per minute. It takes students about six minutes to familiarize themselves with 43 code characters. My tape is a major breakthrough! (Available from Kawa Records, P.O. Box 319-ST, Weymouth MA 02188.)

I have been working with a 75-year-old retired mathematics instructor/high school principal to create text for a newer and faster version of "The Rhythm of the Code" at 20+ wpm and he explained the following to me:

The human mind responds to rhythm. When we speak there is a rhythm to it. When we write (like your editorials) there is a rhythm to it. When a rhythm is applied to Morse code it becomes simple to learn. The "Rhythm of the Code" tape does this.

When you were in the Navy, did you ever notice a certain rhythm to a Navy ship CW call, such as NEFM or NERK (tap your foot while you sound out these rhythms)? Get it? This is the principle I used in my method and will use in future versions of "Rhythm of the Code" that I will create.

Phillip—My code tapes aren't any different from most others, or from random code generated by a computer program. The difference has to do with not learning the characters before you start. This is insidious in that it sets up a look-up table in one side of the brain. The ear output is fed into the other side. The next step is to send the dots and dashes over and look up the character. Then the character is sent back to be written. It's this back and forth activity which causes the so-called plateau at 10 wpm. That's the speed of the brain. When you reach that you are deep into frustration territory.

The fast way to learn the code is to start listening to random code at the speed you want to learn. Start listening for E's and write them down as they go by. There's no thinking whatever involved. You are training your hand to write what your ears hear automatically. This quickly becomes a subconscious operation and thus is far faster than the look-up system. Once the E's are automatic, add T's, and gradually work your way through the alphabet. It's easier to learn the most-used letters first: ETAION SHRDLU.

Most people can learn 13 per in about two days this way. 20 per doesn't take much longer.

The whole idea is to make the operation completely automatic so the op doesn't have to think or even listen. Otherwise, one missed letter and a word is gone before the hapless op can get back with it.

No, I never noticed any rhythm to Navy Fox. It just came at 18 per endlessly, 24 hours a day, 365 days a year, in five-letter groups. But you know, with today's data transmission rates, we could send 50 years of Fox in 3.35 minutes? I still remember the BIMEK, CAQOF, and FUSAJ prefixes for Fox, telling us what deciphering system to use. Cheers . . . Wayne

Pete Bartholomey KD4GKQ, Jacksonville FL I would like to recognize one of your feature writers, Richard Togashi KN6PK, concerning his "Fast Charger" article in the May 1994 issue.

When I attempted to gather up the parts for this project I discovered that Digi-Key had discontinued stocking the 47 µH inductor (TK4355).

I mailed a letter to Mr. Togashi on May 18, requesting a substitute. He not only sent me a spare inductor that he had on hand (which I received on May 31), but also described how to modify a Radio Shack part if I wanted to construct the other version of the Charger described in the article. I wish to thank him for his instant response and for not leaving me high and dry without a replacement part. I trust that the rest of your staff is as concerned about your readers as he is and look forward to all the great projects *73* will come up with in the future. Keep up the good work.

Richard Mollentine WAØKKC, Overland Park KS Wayne, your comment that some men take ham radio too seriously could upset their wives. A good clue to the lady should be when the minister says, "And do you take this ex-young-lady, etc." and he answers, "Fine business," and later that night he kisses her and retorts, "73 and 88."

John W. Luebs N2PMQ, Camillus NY Wayne, your June 1994 editorial has moved me to respond.

I get so disgusted with the total lack of organization of your remarks each month, but I'll have to admit, I keep the magazine near my easy chair for many days until I can wade through everything. *73* stays in my living room longer than *CQ* or *QST*, and gets better read than any other magazine, as I want to eventually read all the many ideas and concepts you have to expound upon.

I would like to address a topic from your recent column: hamfests.

This past weekend my family and I participated in the Rochester Hamfest & Computer Show in Henrietta, New York. We drove the 85 miles from Camillus on Friday afternoon, took lodging in a motel, and attended the VIP dinner at the Marriott that evening. There, along with about 135 other hams and their families, we rubbed elbows and conversed with many of the organizers of the hamfest, bigwigs from the ARRL and *CQ* magazine. The "good ol' boys" were solidly in charge of this one. Talk about the "mossbacks" in the hobby. They were all there. My 10-year-old son and I were probably the only no-codes in the room.

This is the biggest hamfest in the Northeast. The facilities at the County Fairgrounds are inadequate to accommodate all the events, so the seminars were at the Marriott Inn, three miles from the other commercial activities. I doubt that many of the attendees took much interest in the seminars.

This year, I took a stall in the flea market to sell some unwanted equipment. I was one of hundreds of vendors. The amount of old, used and unwanted equipment was absolutely fantastic. Unfortunately, the number of vendors outnumbered the buyers, especially during Saturday. There were times when you could have shot a cannon down any aisle and not hit anyone. Prices came tumbling on computer items and great buys in complete computer outfits were finally down around $30 and still moving. Several vendors near me commented on how poor the sales were, and many were folding up by early afternoon on Saturday.

I have no official tally on the event, but I have heard that the total attendance was below previous years. As in the recent past, this hamfest was cosponsored by *CQ*. For us, it was a great disappointment, but we had fun even if we didn't sell much. This traditional hamfest seems to be going the way of others in upstate New York. Reports from several earlier events in this area this year indicate that ham interest is dropping rapidly. The economy may have something to do with it, but I suspect most of the cause is covered in your editorial comments.

As you may surmise, I share many of your ideas and attitudes toward the amateur radio hobby. I too am concerned that the ARRL and the "good ol' boys" still dominating the hobby will cause us to lose much of our frequency spectrum, and further defeat the growing opportunities for radio activities with the new technologies. I wish I could do more, but you are doing quite a bit. Too bad your circulation isn't better. By the way, your magazine is getting better, and advertisers seem to be increasing.

QRX . . .

Photo Search

Uncle Wayne wants you to shoot our next cover photo! Suitable subjects would include ham radio equipment, amazing antenna arrays, or better yet, catchy ideas of your own. Keep in mind that our format calls for a color photo which is: 1. Vertically-oriented; 2. Sharply focused; 3. Leaves extra room at the top and left side; and 4. Not too busy. We prefer 35mm prints.

Send your color prints to *73 Photo Search, 70 Route 202 North, Peterborough, NH 03458.* Please include a brief description of your photograph, your full name and callsign, and your permission to publish. We cannot return photos without an appropriately-sized SASE. If we do not use your photo on the cover, perhaps we'll find a spot inside. We've even been known to occasionally pay money for a good job. Good luck!

What's Your Expiration Date?

Amateurs receiving new or modified FCC licenses after June 8, 1994, should look carefully at their expiration date. Only new, first licenses or specific renewals are being given a full 10-year term. License upgrades, change of address, callsign, or name are now being processed with the original expiration date intact, instead of an automatic 10-year extension.

New software in the FCC's computers is now processing amateur radio licenses the same way as other Private Radio Service licenses. You should still submit renewal applications 60 to 90 days before expiration. Eventually, the FCC intends to mail expiration notices to amateurs. Renewals require a completed Form 610 sent to the FCC's licensing division in Gettysburg, Pennsylvania. *TNX Westlink Report, No. 676, July 19, 1994; ARRL.*

Going Up

If you plan on buying a new piece of ham gear that is made in Japan, you may want to do it now. Prices are expected to skyrocket soon due to the changing value of the yen versus the US dollar.

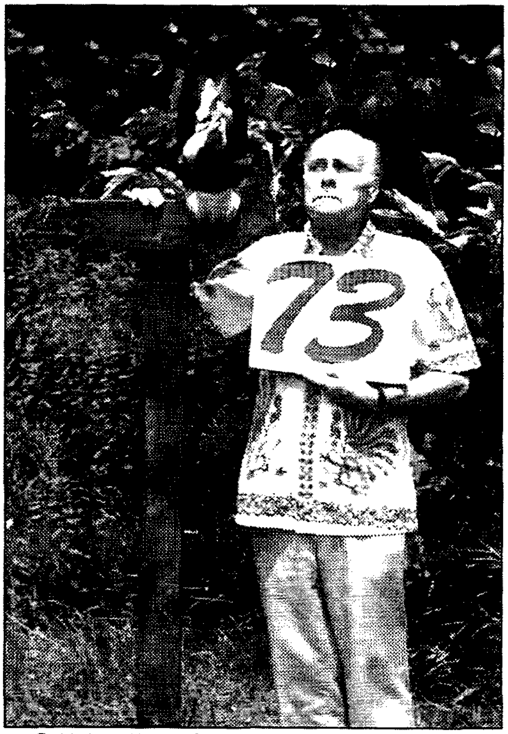
At press time, the US dollar has fallen to a new post-WWII exchange low. A year ago, a dollar would buy 125 Japanese yen. Currently, a dollar will only buy about 97 yen. Add to that the deep recession in the Japanese economy and you can see that it is unlikely that manufacturers can afford to cut prices to keep up with the exchange rate. *TNX Westlink Report, No. 676, July 19, 1994; Newsline.*

Less is More

Vice President Al Gore's call for the government to reinvent itself is leading to a reorganization at the Federal Communications Commission. What exactly will change is as yet unclear, but the FCC's Private Radio Bureau and licensing procedures are likely to be involved.

Rumors persist that there will be a new Wireless Services Bureau, possibly headed by current Private Radio Bureau Chief Ralph Haller. A new International Bureau, designed to coordinate global communications issues may also be in the works.

Whatever form the realigned FCC takes, it will have to be financed with less than anticipated revenues. The commission had hoped to get a $188.4 million budget approved for fiscal year 1995, but the House Appropriations Committee lowered that figure by nearly $20 million. *TNX W5YI Report, Issue #14, July 15, 1994.*



73 Publisher Wayne Green is entering his own 73rd year this month with no end in sight. In fact, reports of buzzards circling overhead are greatly exaggerated. The venerable entrepreneur is marking another milestone this September as well—73 magazine is entering its 35th year of publication. Time marches on! (Photo by Charles Warrington WA1RZW.)

Enter the DBS Era

It is being touted as the biggest launch of new consumer electronics technology in history. With most of the nation still totally unaware, the age of high-power Direct Broadcast Satellites (DBS) has begun. DBS is expected to be available nationwide by the end of this year!

Cable companies should be concerned, because DirecTV (GM Hughes Electronics) and USSB (Hubbard's US Satellite Broadcasting) have quietly rolled out their DBS offerings—a first step toward a 500-channel service. Currently, the DBS services are being test-marketed in Shreveport, Louisiana, and Jackson, Mississippi.

To receive DBS, you need a set-top digital satellite receiver/decoder box that links the TV to a small 18" dish antenna. Total cost of the needed equipment, including remote control, ranges from $650 to $900, depending on features. A major television ad campaign promoting DBS is set to launch this month. *TNX W5YI Report, Issue #14, July 15, 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on CompuServe ppn 70310,775 @compuserve.com; or at the *73* BBS at (603) 924-9343 (300-2400 bps), 8 data bits, no parity, one-stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

Compact 160 Meter Transmitting Loop Antenna

You don't need to move to a new QTH!

by Richard Q. Marris G2BZQ

The 160 meter band (1800-2000 kHz) is beyond the reach of a high percentage of transmitting amateurs. Yet, this band can be most enjoyable, usually with a very high standard of operating. But—there are problems!

The fact is that most TXers have near-impossible antenna problems. These are: 1) a lack of sufficiently large real estate to erect an antenna; 2) local antenna restrictions regarding putting up a large antenna; 3) the impossibility of installing the necessary efficient ground system; 4) the apartment dweller's lack of antenna space; or 5) the "no TX antennas here" syndrome. Probably over half of the licensed amateurs live in apartments, or have very restricted space for a large outdoor antenna, or face "rules and regulations," or other restrictions.

The answer to "getting on the air" on 160 is a small indoor vertical multi-turn tuned loop which, though small in size, is difficult to load and match to the TX. If a balanced configuration is used, it will operate without a ground connection. Properly designed, such a loop will give yeoman service. It obviously will not compete with a 160 meter dipole or a Beverage, however, which few have space for.

The size of the loop will be dictated by the domestic space available, the amount of wire required (in turns!), and the absolute necessity to finish up with a design with *an exact number of complete turns*, i.e. no half turns, quarter turns or other part turns. Strangely enough, the proximity effect is far less critical than on 80 meter or higher band loops.

The circuit is simple but novel (see Figure 1), and shows six square loop turns resonated by variable capacitor C1 (with C2 in series), and loaded with coil L2, with a 50-ohm impedance matching tapping point. An optional ground connection is shown but, unless a really good radial ground is available, it is better not to use one at all at the loop. I use a water pipe as a ground, connected to the TX/RX input socket, and not the loop. The loop has been used with about 7 watts CW.

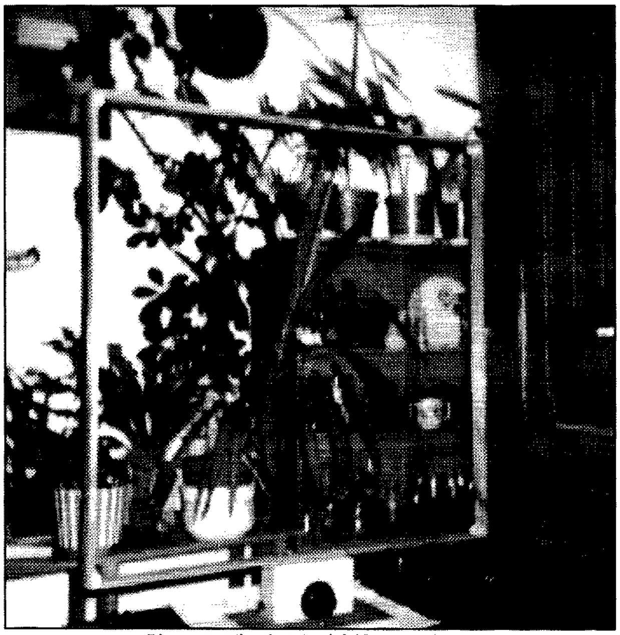


Photo A. The finished 160 meter loop.

Figure 2 shows the neat profile of the loop. It consists of six wire turns wound around a 36" x 36" timber frame, mounted on a plastic box containing the resonating/loading/matching circuitry.

At this QTH the loop stands on a table alongside the operating position, with the tuning knob (C1) within easy reach. Operating is made easier with a large instrument knob. The room is about 20 feet above ground level. No doubt the more ingenious could stand the loop on the floor of a loft, with a conventional remote control turning mechanism.

C1 is a robust 150 pF variable capacitor, which was available, with a 150 pF high voltage (2KV) capacitor (C2) in series. Depending on availability, C1 and C2 could be replaced with a single 75 pF variable.

Construction

The main frame (Figure 3) is made of 1-1/4" x 3/8"-thick seasoned timber. This is assembled, as shown, to give a 36" x 36" square frame, reinforced with wood corner blocks and glued together. The whole frame is rubbed down with fine glass paper, and finished with teak wood stain. Onto this frame are wound six turns of 16/0.2mm PVC-covered wire (o/d = 1.8mm). This wire is rated as 3 amps at 1000 volts RMS. The wire turns are equi-spaced to approximately 1/4" apart, from center conductor to center conductor. The loop turns are terminated as shown in Figures 3 and 4C.

The tuning/matching unit (C1 + C2 + L2) is built into a gray (see the safety note at the end of the Parts List) plastic box 7-1/4" x 3/8" x 2-3/8" (see Figures 4A and B). The box is bolted (with the lid to the rear) to a solid wood base 12" x 8" x 1/2".

L2 is a self-supporting coil consisting of 30 slightly-spaced 1" diameter turns of 16-gauge tinned copper wire. The top end of L2 is soldered to a thin brass bolt through the box top, and hangs down, so that the bottom end is soldered to a thin brass strip used to connect the frame of C1 to the outer of the coaxial socket. The socket center conductor is tapped, via a short lead, to L2 (described later in this article).

The loop frame/winding (see Figure 3) is bolted to the top of the plastic box, using nylon bolts/nuts/washers (see Figure 4C) which

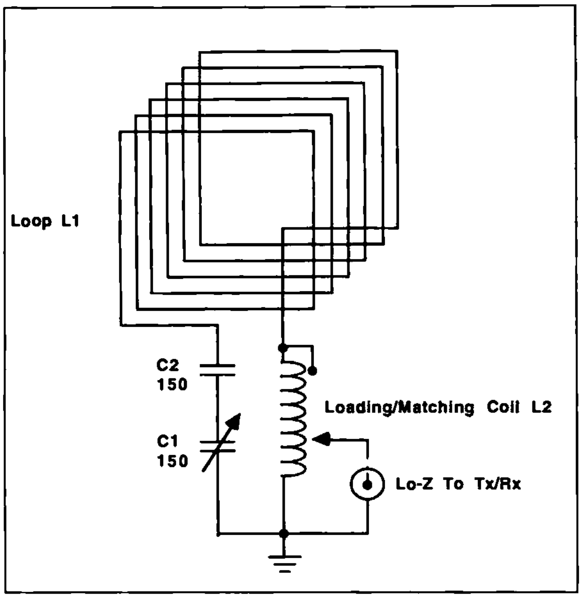


Figure 1. The circuit.

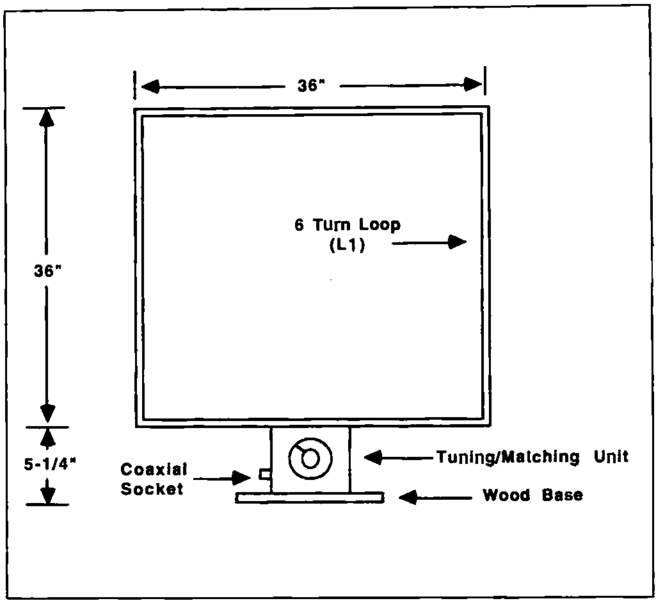


Figure 2. Loop profile.

pass through between turns three and four of the winding. Do not use metal bolts as these may partially RF short adjacent turns.

The loop is connected to the TX/RX with a short length (5 feet) of RG58 feedline.

Getting On The Air

The top tap on L2 (from end of L1) will determine the frequency range. For maximum efficiency, C1 should be set as near zero pF capacity as possible, at the HF end of the band (i.e. 2000 kHz).

The impedance matching tap from the coaxial socket is connected for the best impedance matching for 50 ohms. On the prototype this was at 19 turns up from the bottom of L2, and this should be used initially while the loop frequency range is adjusted.

Checking the frequency range on a receiver turned to 2030 kHz, try shorting out turns, from the top of L2. On the prototype it was necessary to short out the top two turns, to resonate the loop, on the RX, at 2030 kHz

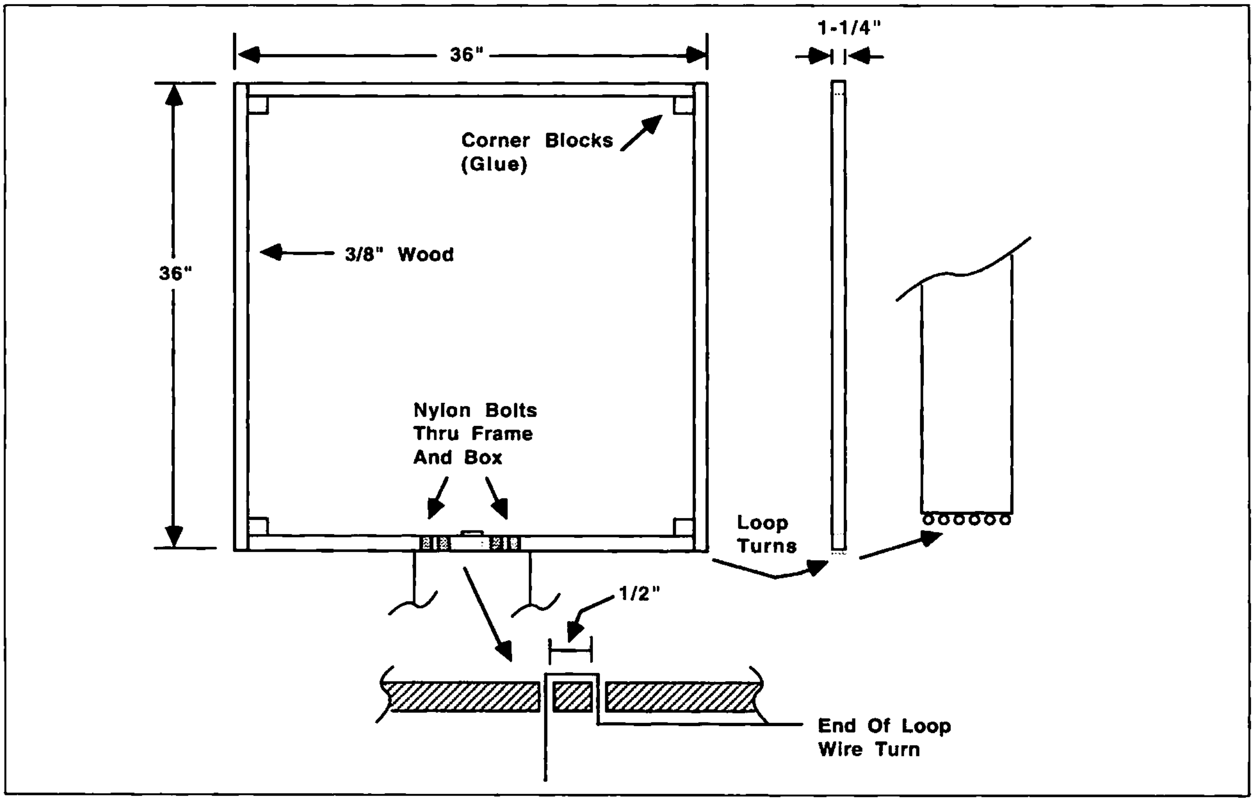


Figure 3. Main frame and loop winding.

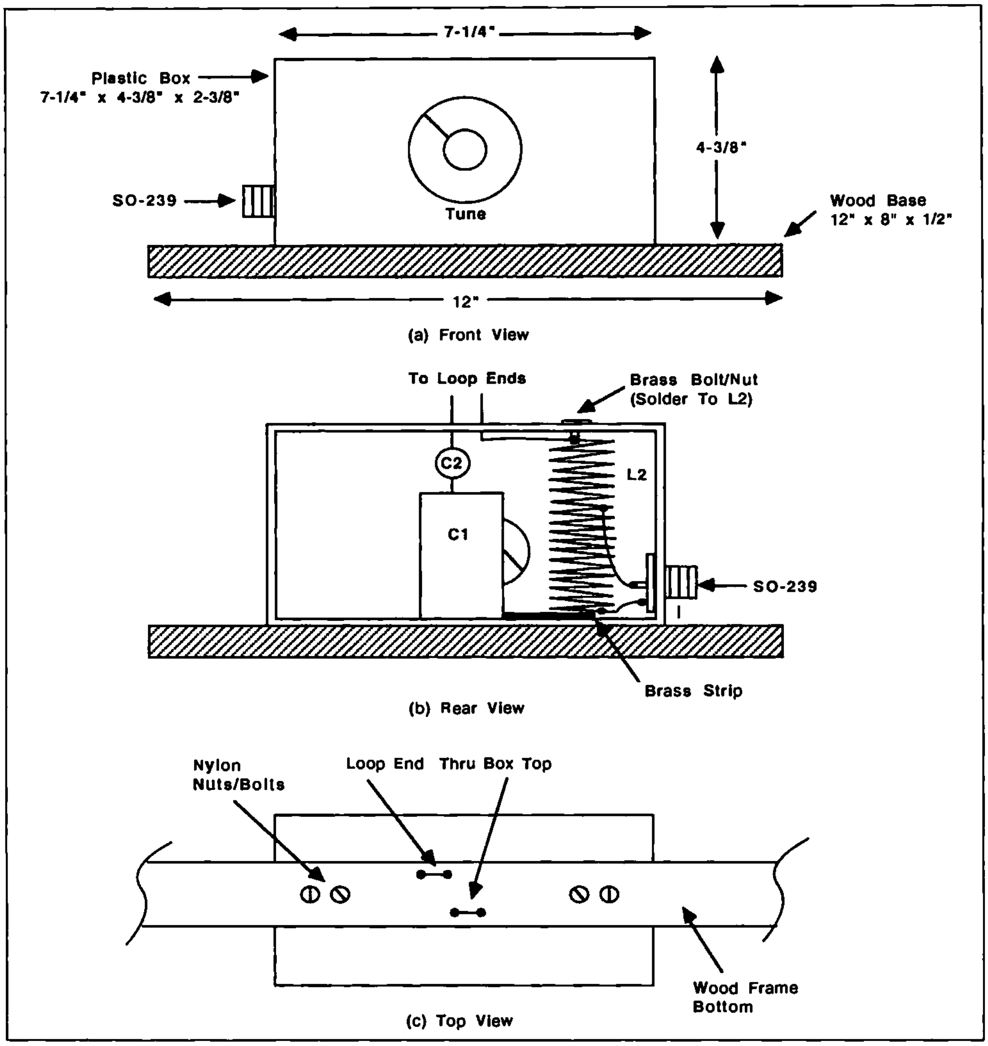


Figure 4. Tuning/matching unit.

with zero capacity on C1. It follows that to resonate at the 2000 kHz HF band edge, it will require a small amount of capacity on C1. The loop will now resonate throughout the band by adjusting C1, with no further coil adjustment necessary.

Apply a few watts to the loop and it should load quite easily at the TX frequency. Due to the possi-bility of minor differences in individual construction, the impedance matching tap, on L2, should be tried +/- a little to obtain best matching.

The loop is now ready to try "on-the-air." The usable bandwidth, on a fixed setting of C1, is about 11 kHz on the prototype. The advantage of this narrow bandwidth is twofold: The loop acts as a comparatively narrow bandwidth band-pass filter eliminating harmonics and TVI; it also reduces ambient noise and general man-made interference on the receiver. The loop has been used with about 7 watts CW with the TX having a Pi-output circuit.

Remember: TX frequency = loop resonant frequency = RX frequency. Have fun!

Parts List

Qty.	Part
1	Variable capacitor (C1) 150 pF wide space receiving type (see text)
1	Capacitor (C2) 150 pF silver mica or ceramic disc (2 kV)
1	2 oz. reel ol 16 gauge tinned copper wire.
1	Coaxial socket
Loop wire	16/0.2mm high temperature PVC wire (o.d.= 1.8mm), 3 amps at 1000 volts RMS
1	Plastic box (*not black) 7-1/4" x 4-3/8" x 2-3/8" minimum
2	Lengths of dry seasoned timber 6'0" x 1-1/4" x 3/8"
1	Small tin of teak wood dye and glue
1	Baseboard 12" x 8" x 1/2" timber

*Safety—Plastic Boxes: It has been suggested that some *black* molded plastic boxes are made using recycled plastic, and that carbon black is used lor black coloring (obviously not good at RF). It has been impossible to check this as many boxes are molded in Taiwan, etc., so: Safety First.

Number 5 on your Feedback card

The Discriminator

A directional receiving antenna for hams and SWLs.

by Richard Q. Marris G2BZQ

The Discriminator is a ferrite loop high performance experimental directional receiving antenna, designed for use between 1600 kHz and 4000 kHz. This frequency range covers the 80 and 160 meter amateur bands, marine beacon and communication bands, some aircraft activities and, of course, a large number of broadcast stations worldwide. It should be of interest to both the TXing and SWLing amateur.

The circuit is pictured in Figure 1. The design will produce a perfect figure-eight polar diagram with acute nulling at 90 and 270 degrees (Figure 2A). In addition, with the aid of an optional sensing rod antenna, the polar diagram can be changed to a cardioid configuration, as shown in Figure 2B.

Mounted on a turntable, the Discriminator will eliminate QRM and QRN, and also, with some practice, will, if required, give direction-finding facilities.

The Figure 1 circuit shows a balanced ferrite rod loop L1 tuned by C1A and C1B, coupled to the receiver's 50 ohm input via L2. The nickel zinc ferrite rod is unusually 15" long and 1/2" in diameter. This long rod substantially increases the RF signal voltage. The winding width of L1 is about one ninth of the total rod length, so very acute nulling is achieved, to a far greater extent than would be expected with a single 7-1/2" or shorter ferrite rod. For those not requiring sensing facilities, the ferrite loop L1, C1A, C1B, and L2 can be used as an efficient entity (see the right side of the assembly profile in Figure 3).

To produce an optional cardioid polar

Continued on page 18

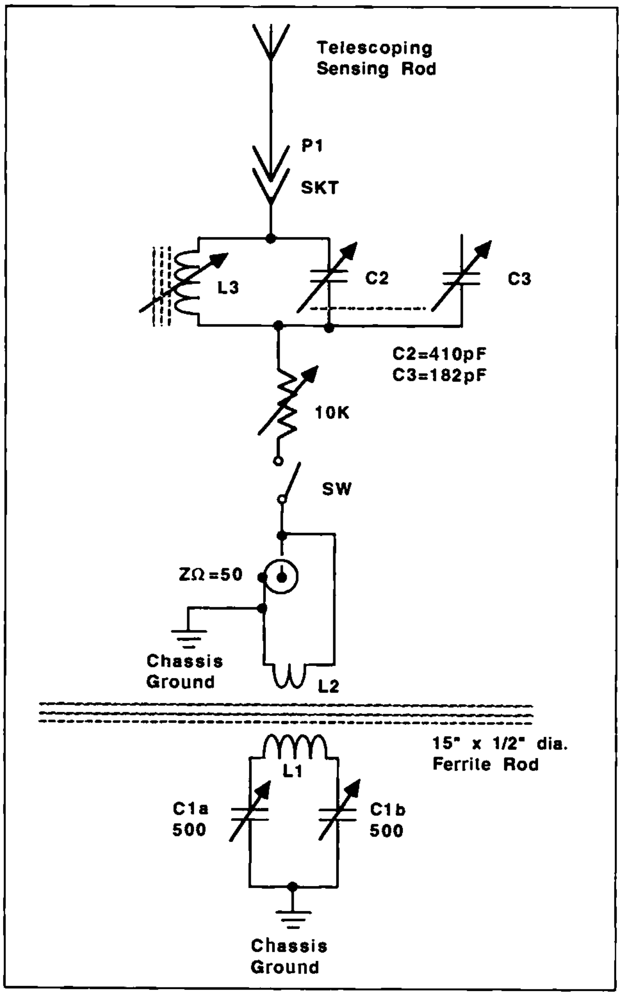


Figure 1. Circuit.

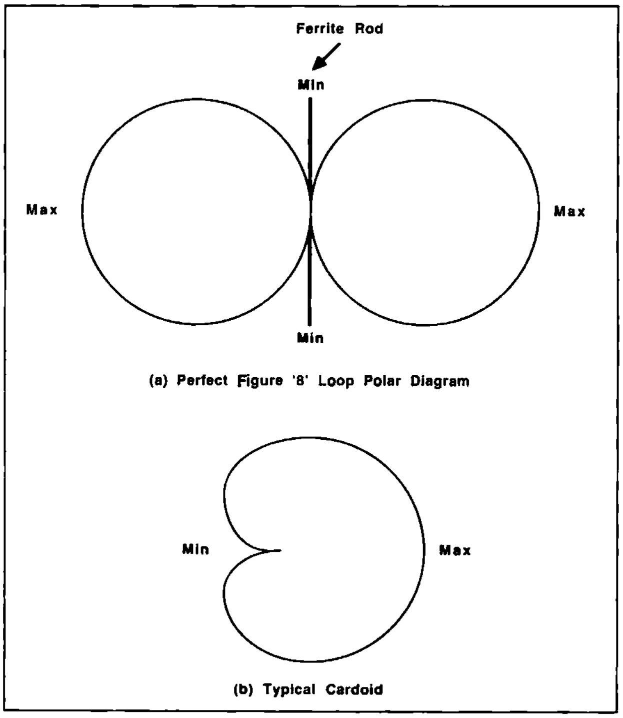


Figure 2. Polar diagrams.

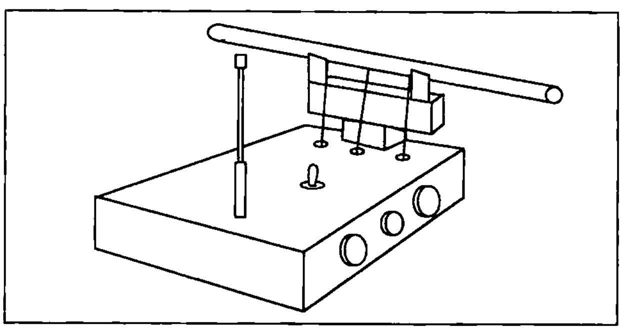


Figure 3. Profile.

diagram (Figure 2B), the sensing circuit consists of a short vertical sensing rod resonated to a quarter wave by L3/C2, with a 10 kilohm variable phasing control resistor R. The switch SW enables this sensing circuit to be switched in/out when required (described later in this article).

The original very experimental proving model was assembled on a sheet of circuit board, with the sensing rod stuck out on a wood boom arm. Two things became immediately apparent: A 15" horizontal ferrite rod was very vulnerable to damage and would require protection; and the vertical sensing rod, on its horizontal boom together with a 15" rod, produced a most ungainly and unwieldy contraption. The problem was solved with chassis construction: a robustly protected ferrite rod assembly, and a plug-in telescopic sensing antenna rod.

Construction

The whole final assembly was built on an aluminum chassis size 8" wide x 2-1/2" deep x 2-1/2" high. The profile (Figure 3) and layout (Figure 4) shows the horizontal 15" ferrite rod on the right, with the control knob of resonating capacitor C1A and B to the righthand front. The vertical sensing rod plugs into extreme left with the resonating capacitor (C2) knob in front. The phasing resistor knob is in the center front, with switch SW above on the chassis. A very essential dimension is the 6-1/4" distance between the sensing rod and ferrite rod. If the cardioid sensing facilities are not required, then the chassis width could be reduced to 3" or so. If necessary, there is room for a wideband RF amplifier under the chassis, which has a removable bottom plate.

The chassis underside (Figure 4) is self-explanatory. C1A+B is a conventional 500 + 500 pF U-frame variable capacitor, mounted on the chassis front. C2 + C3 is a similar 410 pF + 180 pF variable mounted on an insulating bracket, with insulated control shaft. Variable resistor R is direct on the chassis front.

L2 consists of 30 close-wound turns of 22 gauge enamel copper wire wound on the end of a 1-1/2" x 1/2" diameter paxolin tube, and fitted with flex ends. The 3/8" diameter ferrite rod was cut to 1-1/2" from a length of salvaged rod from an old radio.

The step-by-step fabrication of the ferrite rod L1 and L2 assembly is shown in Figures 6 and 7. Two 7-1/2" long x 1/2" diameter nickel zinc ferrite rods, type R61-050-750, are adhered end to end (see Figure 6A). The rods' ends are cleaned with fine glass paper, and adhered together with a cyanoacrlate adhesive (e.g. Superglue). It sets within a few seconds. Next, wind one turn of 4"-wide self-adhesive label at the rod center (see Figure 6B). L2 is close-wound using 36 turns of 0.9mm o.d. PVC-covered 10/0.1mm connection wire (see Figure 6C), with the ends held in position 4" apart by 1"-wide masking tape. Over this wind two turns of 1"-wide masking tape at the center of L1, over which wind four turns of PVC

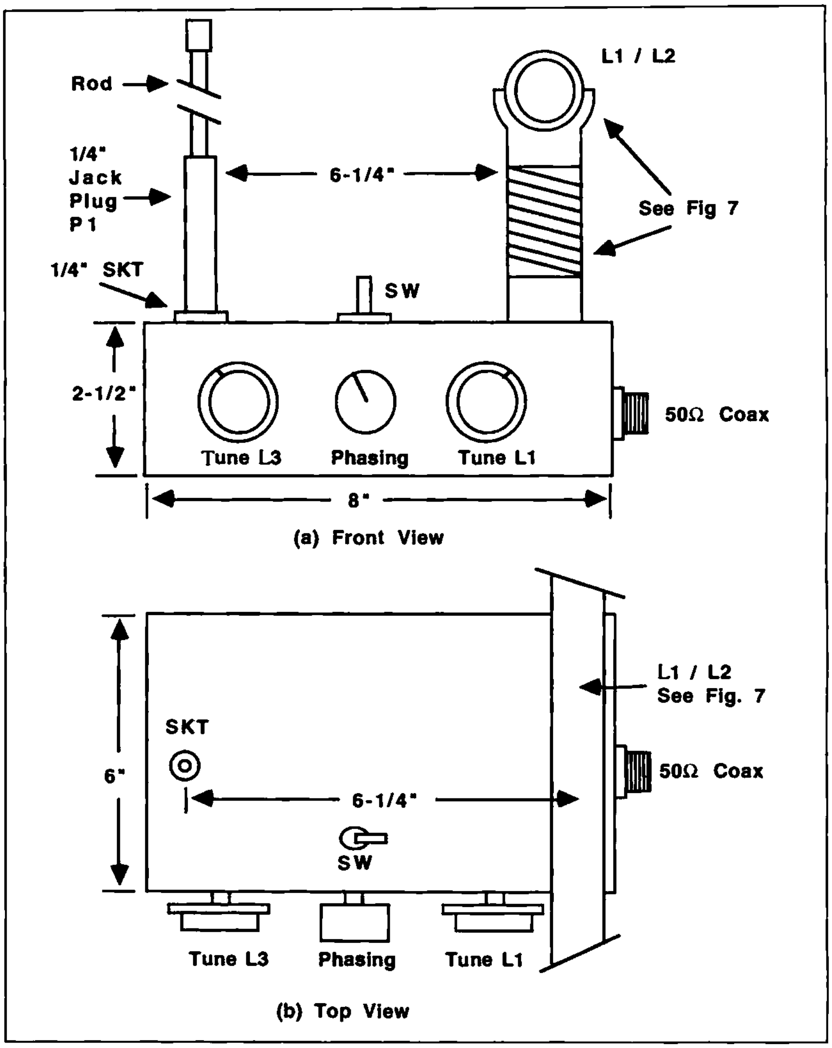


Figure 4. Layout.

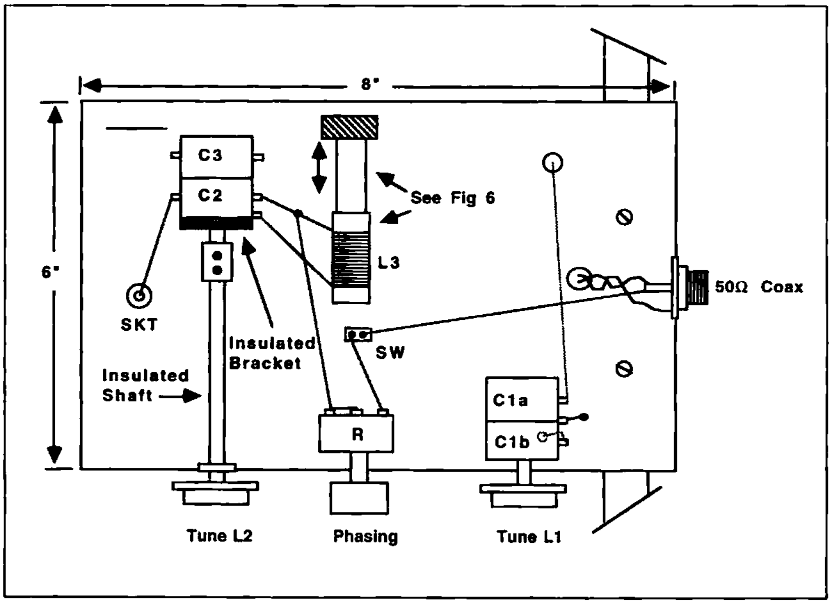


Figure 5. Underview.

hookup wire, with the ends twisted lightly together, as shown in Figure 6D.

The above assembly is protected and mounted, as shown in Figure 7A, in a 16" length of 7/8" o.d. PVC pipe used in plumbing, mounted and held in place on a robust "T"-shape wood frame and held to the main chassis with wood screws. Three 1/4" diameter wire exit holes are drilled in the tubing, one at the center and the others 4" apart as shown in Figure 7C. The rod/winding assembly is inserted into the tubing and the coil wire ends pulled through the 1/4" holes. The rod ends are supported by coils of 2"-wide thin coiled card, inserted into the ends of the tube around the rod ends. The "T" support, shown in Figure 7B, is made of dry timber, varnished, with two plastic tubing wall clips screwed on either end (shown in Figure 7B).

The plug-in sensing antenna rod is a standard 20" telescopic whip. The end is soldered to a 1/4" plastic-sleeved jack plug center connection. A corresponding jack socket is fitted to the main chassis (see Figures 4A and Figure 5). The distance from this socket to the center of the ferrite rod assembly was calculated by experiment and is 6-1/4" (see Figures 4B and 4A).

The whole underchassis assembly and wiring is shown in Figure 5.

Setting Up

The unit should be connected to the receiver input with not more than 36" of RG58 coaxial feedline. Set-up procedure is as follows.

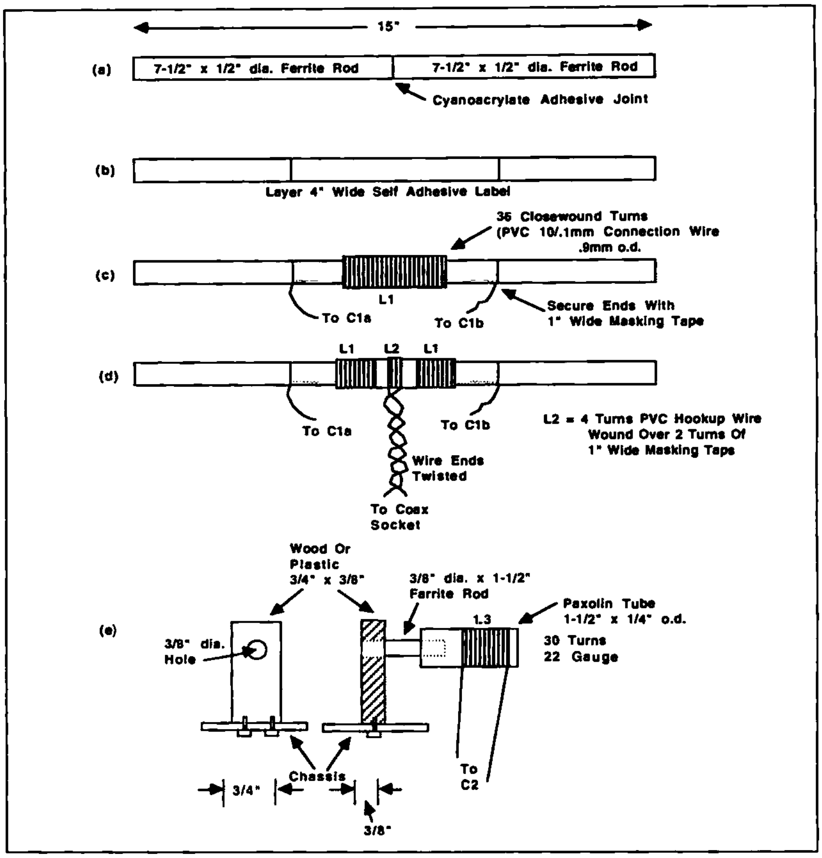


Figure 6A, B, C, D: Ferrite L1 and L2 assembly; E: coil assembly.

(1) Ferrite Rod/L1/L2 Assembly: With the sensing rod removed and the switch OFF, set the receiver to a signal around 2000 kHz and rotate C1A and B to resonance. Rotate the unit for maximum signal—see the polar diagram in Figure 2A. Rotate the unit to check the acute nulling. Repeat this operation at 1600 and 4000 kHz, and spot frequencies in between. The prototype covers from 4100 kHz to below 1600 kHz. This part of the unit can, as previously mentioned, form a self-contained, highly efficient ferrite rod antenna on a reduced 3" wide chassis, producing the polar diagram shown in Figure 2A.

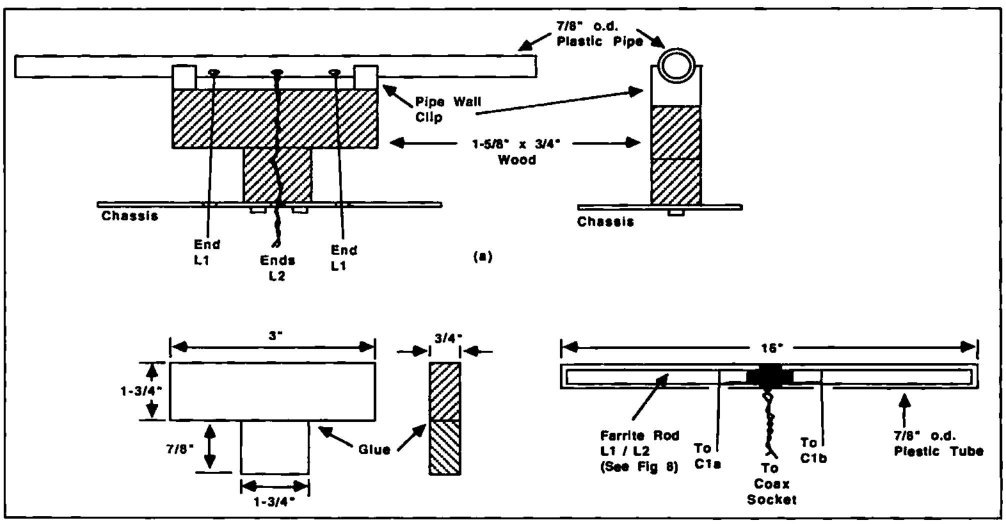


Figure 7. Ferrite rod coil and support assembly.

(2) Sensing Rod Circuit: Plug in the telescopic whip, put the switch to OFF and rotate C2 to near minimum capacity. Tune the ferrite loop to a signal at 4000 kHz with C1A+B; put switch SW to ON and, with the phasing resistor at around midposition, slide L3 along the short ferrite rod (see Figure 6) until resonance is found, then seal L3 to the rod with hot candle wax. The sensing rod circuit should now operate between 4000 and 1600 kHz. It can be extended down frequency by connecting C3 in parallel with C2.

Operation

In operation with the ferrite loop used with the sensing circuit in the OFF position, tune C1A + B to the required frequency. Maximum signal is *broadside to the ferrite loop*, and minimum signal is on the rod ends. The nulling is extremely sharp and eliminates most QRM and QRN. The chassis bottom plate must be fitted for full screening. With a high RF gain receiver a preamplifier has not been necessary but, if required, a wideband RF amplifier circuit

board can be fitted underchassis.

With sharp nulling and a figure-eight polar diagram, it is possible that a station on the 180 degree reciprocal bearing could interfere with the wanted station. If this occurs, the sensing switch can be switched on to change the polar diagram to the cardioid pattern (Figure 2B), with a large single forward lobe, and the null now at the back. With C2L3 tuned to resonance and the telescopic whip 17" long, the phasing resistor should be adjusted so that signals from the sensing rod and ferrite are equal in amplitude. In practice, the cardioid null is not as pronounced as that shown in Figure 2A, but the forward lobe is larger. So, in practice, with a flick of the switch it is possible to change from one polar diagram to the other.

Introduction of the sensing rod also enables the user to find the directional bearing of a station, assuming a simple turntable is placed under the unit. It will also indicate the bearing of persistent QRN. ■

Parts List

Qty.	Description
2	Ferrite rods, 7-1/2" long x 1/2" diameter; type R61-050-750 (Available from Amidon Associates Inc., 2216 East Gladwick Street, Dominique Hills CA 90220 USA
1	2-gang 500 + 500 pF variable capacitor with knob
1	2-gang 410 + 182 pF variable capacitor or single-gang 400 pF (such as 500 pF with series capacitor) insulated coupler shaft and knob
1	10k ohm carbon track variable resistor with knob
1	1-1/2"-long x 3/8"-diameter ferrite rod (cut some BC receiver-type rod)
1	1-1/2" x 1/4" o.d. paxolin or plastic tubing
1	Aluminum chassis with bottom plate, 8" x 6" x 2-1/2"
1	20"-long telescopic antenna whip
1	1/4" (6 mm) mono jack plug with plastic (not metal) sleeve
1	1/4" mono jack socket
1	Mini ON/OFF toggle switch
1	Chassis mounting coaxial socket plus 36" maximum RG58 feedline with suitable plugs
1	16" length of 7/8" o.d. UPVC plumbing piping with two standoff wall clips
Wood	1-3/4" x 3/4", one piece 6" long and one piece 7/8" long 1-3/4" x 3/4" x 3/8" hardwood
Wire	22 gauge enamel copper wire for L3 PVC 10/0.1mm connection wire 0.9mm overall o.d. for L1
Sundries	1"-wide masking tape; cyanuacrylate adhesive (Superglue or similar); nuts, bolts, washers and roundhead brass wood screws

Low-Cost Transmission Lines

What you don't know can cost you.

by Frank Kamp K5DKZ

At first glance, this title seems to contain a conflict of terms. Transmission lines are the more significant part of the cost in most simple antenna systems. We all like the convenience of using coax, even if it is not the most economical solution. After all, what else is there? Open-wire line and twin lead require an antenna tuner. That at least gives us a choice, but the expense is still there, either in the cost of coax or the purchase of an antenna tuner. Bargain-style coax is not a good solution. It is usually either of very questionable quality and has poor shielding, or it's embrittled with age.

For medium and high power use, RG8 or equivalent is the most logical choice in coax. It's heavy enough to handle the power. It's also heavy enough to require some pretty stout wire and supports if used in a flat-topped dipole installation with no center support. Then, if you want to add a balun at the antenna feed point, you compound the weight problem.

Twin lead is the most obvious solution. It can be matched to a short length of coax through a 4:1 balun for easy routing to the shack. That helps the situation somewhat, but what if our antenna does not match 300 ohms and we don't want to use a balun at the elevated feed point? We could always construct the dipole from twin lead, giving us our impedance match and broadband performance at the same time. That solution also has its drawbacks. Twin lead does not weather as well as simple wire and coax. The cheaper, receiving type of twin lead may not handle the full legal power limit.

The variations and permutations of this decision-making process seem endless because there are so many variables involved. What we really need here is some magic do-everything transmission line that can provide more options to deal with these variables. Chief among these options would be a line made from inexpensive materials that can be used without worry regarding impedance match to the antenna. Such a device does exist; it can be made from inexpensive materials, or from almost any type of wire or cable. You could even use that 1,000-foot roll of lamp cord that was such an irresistible bargain two years ago.

An electrical half-wave section of transmission line has the unique property of mirroring impedance from one end to the other. For all practical purposes, the electrical properties seen at one end are the same as at the other end. The reaction of most people when they are first introduced to this well-known fact is "So what?" The conventional use of transmission lines takes advantage of the fact that such a line has a characteristic surge impedance for *any* physical length. All that is needed is termination in that characteristic impedance at both ends. However, the mirroring ability of a half-wave transmission line becomes infinitely more useful when we realize that it has nothing to do with the surge impedance of the line. This means that we can use virtually any two conductor lines available to physically bring the electrical equivalent of the antenna feed point down to ground level where we can more effectively deal with our matching problem.

The Procedure

The key here is to ensure that the nondescript line is equal to a multiple of *electrical* half waves in length. The downside is that this trick will only work on exact multiples of a fundamental frequency. A line cut for 3.5 MHz will also work on 7.0 MHz, 14.0 MHz, and 28.0 MHz. A line cut for 3.9 MHz will work best on 7.8 MHz, 15.6 MHz, and 31.2 MHz. As you can see, multiband operation using this concept is somewhat limited unless we use an antenna tuner. The other problem is determining what physical length of cable corresponds to an electrical half wave at your chosen frequency.

The electrical half-wave length of any transmission line will *always* be physically shorter than the length calculated from the formula: half-wavelength in feet = 468/frequency, in MHz. The ratio between its shorter physical length and the length from the formula is known as the velocity factor of the line. Velocity factors for various popular transmission lines can be found in *The ARRL Handbook*. You won't find lamp cord listed there.

You can calculate the velocity factor of any line with nothing more than your station equipment using the following procedure (use a frequency in the 10 meter band to avoid wasting any more of your valuable lamp cord than necessary): From the formula above, calculate the half wavelength in feet for the frequency you are using. Cut a section of lamp cord to this length. Connect the output of your transmitter to a dummy load using a short length of coax in series with your SWR meter. Tune up on frequency using as little power as possible. Note and record the SWR into the dummy load—it should be very close to 1 to 1. If it isn't, check your hookup and verify that your dummy load is indeed 50 to 75 ohms. Now replace the short length of coax with your lamp cord transmission line (Figure 1). Do not readjust your transmitter except for drive to the final, if needed. Apply power and take an SWR reading—it will probably be higher than 1 to 1. Trim a few inches off the lamp cord section and try again. Continue this until you get the lowest possible SWR—it should be close to what you experienced with the dummy load connected through the coax. Measure the final length of the lamp cord and divide it by its original length. The result will be less than one and will represent the velocity factor of your line cord. Now you can use that value to calculate the physical length of lamp cord required to give an electrical half wavelength on any frequency.

Qualifications

You might be tempted to do this test at 2 meters if you have the equipment. That would waste even less cable, but it may also give you bogus information that will not scale down to HF frequencies. The formula we used is only good for frequencies up to 30 MHz.

Of course, you are not restricted to using lamp cord. Almost any line having two conductors will work, as long as its physical makeup is uniform throughout its length. For instance, using alternate sections of twin lead and lamp cord where each section is less than an electrical half wavelength might not be a good idea. The surge impedance of the line is not a factor, but I don't think that allows it to be a variable through its electrical half wavelength. You could even use a twisted pair, as long as the pitch of the twist is uniform throughout its length. We also need to exercise a little common sense here. You can't bury a section of lamp cord in the ground like you would coax. A twisted pair made from #24 enameled wire might work for a receiving application, but I wouldn't use it for transmitting.

Another example application of this principle is my recent experience with a dual dipole phased array for 40 meters. This is an active array; each leg of each dipole receives power. Some sort of balanced feed was required, but I wanted to use shielded cable to reduce noise pickup on the vertical sections of the transmission lines. I ended up using four electrical half-wave sections of surplus RG62 coax, two sections per dipole. The center conductors of the coax were connected to the dipole legs. The shield of the coax was tied together at both ends of the transmission line and grounded at the phasing network located in a box below the array.

Number 7 on your Feedback card

73 Review

by Bill Clarke WA4BLC

The HOFI Antenna Switch

Quality at every turn.

Electronic Switch Co., Inc.
4343 Shallowford Road, Suite E-6
Marietta GA 30062
Telephone: (404) 518-4634
Price Class: HOFI 605—$94.95;
lightning surge protector—starts at $59.

Like most hams, I switch from one antenna to another on a regular basis. Generally, my antenna selections are made for band-change reasons; however, I also use switching as a means of comparing one antenna to another.

Over the past 25 years I have gone through quite a few antenna switches. Some were made of cast white metal, while others were wafers in project boxes. A few were of fair quality and lasted for several years. However, most just couldn't stand up to the constant use.

Among the failures, I found that the contacts would wear thin or the shafts became loose in their housings. All the switches had a common thread: poor physical construction. Unfortunately, they were all expensive.

I am a believer in paying for quality. If the price is high, the quality should be equally as high. The general appearance of the product should reek of quality, the operation should be smooth, and the product should last indefinitely.

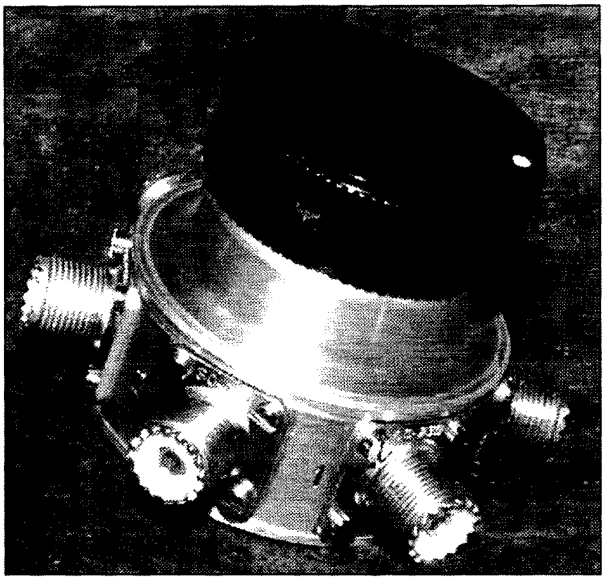


Photo A. The HOFI Model 605 antenna switch.

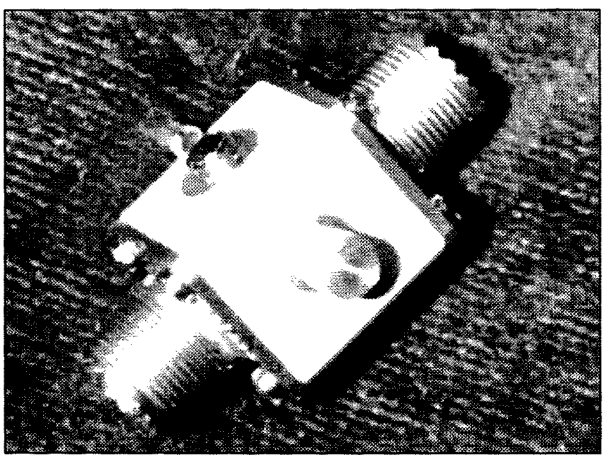


Photo B. The HOFI lightning surge protector.

HOFI RF Switches

The HOFI manual coax antenna switch, called a "hoscha," is constructed of aluminum and stainless steel. It is round, with a large knob, and has connections for five antennas. This one reeks of quality.

The switching action of the hoscha is smooth and very positive, yet requires little effort. As it is a new product to me, I don't know if it will last indefinitely; however, after disassembly and examination, I think it will be around for a long time with no failures. In other words, the MTBF (mean time between failure) will be measured in large increments of years.

HOFI switches are built in Germany, a country famous for its engineering prowess. The company produces a number of different switch configurations, including remotely-controlled antenna switches. This review covers only the manual version.

Construction

The manual series of HOFI antenna switches is available with UHF or N connectors—straight from the switch or at right angles (a yet-to-be-released model will have the connectors exiting directly from the rear plate of the switch):

Model 605:	UHF connectors
Model 2005:	N connectors
Model 606:	UHF right-angle connectors
Model 2006:	N right-angle connectors

The outer shell of the switch is formed by an aluminum drum with a flat rear cover and a spun/raised front cover containing the switching shaft. The shell thickness is nearly 3/16". The knob is over 2" in diameter. The six SO-239s are fastened to the drum with machine screws. The rear plate is drilled and tapped for mounting purposes.

The inner workings of the switch consist of self-cleaning double-knife type contacts. This type of construction provides long-term consistent operation, even at high-power operations. A positive detent provides locking action.

Operation

The switch tested, Model 605, was used to select between five antenna, ground, and dummy load combinations. At no time were any problems noted; however, it is fair to say that it could take years for problems to appear.

I should note that the switch leaves unselected antennas open, rather than switching to ground. Some manufacturers do switch all unselected antennas to ground. When switched to position "0," no antenna is selected and all lines are open. I view this as a "non-problem" in that a direct lightning strike will destroy *any* type of switch. Lightning protection cannot be satisfactorily accomplished by merely switching to ground (or grounding an antenna through a switch).

Lightning Protection

Included with the review unit HOFI antenna switch was a small (about 1" square) lightning surge protector with an SO-239 mounted on each end. On one side is a removable metal plug that allows replacement of the gas-discharge tube, and on another is a lug for connection of the case to DC ground. The basic heavy-duty construction is similar to the antenna switch. The surge protectors are available for power ranges from 500 watts to 7 kW.

Note that the surge protector is not included when you buy the switch; it is a separate item.

Availability

HOFI antenna switches and surge protectors are available from Electronic Switch Co., Inc., at the address above, and through many well-stocked amateur radio supply stores.

Specifications

Impedance	50 ohms	
SWR	Less than 1.06:1	
Insertion Loss	Less than 0.04 dB	
Upper Frequency Limit	200 MHz (500 MHz with N-connectors)	
Power Limits	Below 30 MHz	3,000 watts
	2 meters	1,000 watts (1,200 watts with N-connectors)
	440 MHz	700 watts with N-connectors
Isolation	Below 30 MHz	50 dB
	2 meters	40 dB
	440 MHz	30 dB

73 Review

Number 8 on your Feedback card

by Peter J. Bertini K1ZJH

Computer Automation Technology
4631 N.W. 31st Avenue, Suite 142
Fort Lauderdale FL 33309
Telephone: (305) 978-6171
Price Class: CAT 1000—$679;
CAT 300—$299;
CAT 300 Deluxe—$399.

Computer Automation Technology's CAT 1000 and CAT 300 Repeater Controllers

An outstanding value in a crowded marketplace.

When my radio club, the Mt. Tom Amateur Repeater Assn. Inc., decided to upgrade our repeaters to newer controllers, I embarked on a search for the best value and best controller for our needs. I made several inquiries via packet BBSs throughout the USA, seeking comments from other repeater groups, and was surprised at the favorable comments and fierce loyalty of the CAT controller owners, a controller which had previously escaped my notice.

A Different Breed of CAT

What makes the CAT controller stand out from others in a saturated and highly competitive market? Many things. First, price: The CAT 1000 is the most powerful controller in any price class. Its design is a year old, and thus it uses the latest in technology. We have found the people behind the CAT products to be extremely attentive to our needs and problems. Software upgrades, which simply require that you swap out an EPROM chip on the controller with the latest revision, are periodically released—usually without charge to CAT owners.

I had the opportunity to beta test a CAT 300, and this review will cover that controller as well. But, since the CAT 300 is a scaled version of the CAT 1000, I will deal with the CAT 1000 first, and then briefly cover the differences between the CAT 300 and CAT 1000 controllers. It would be almost impossible to cover in great detail what these controllers can do, so this review will be limited to a brief synopsis of their main features.

Control Channels

The main control functions of the CAT 1000 are broken down into eight zones with eight control channels in each zone, for a total of 64 off/on commands. The zones break down the commands into logical groups of eight commands each, dealing with autopatch, repeater, etc., control.

Voice Messages

A 40-position voice message table permits storage of synthesized voice messages constructed from the 475 word and sound effect vocabulary. Time variable selections are also offered. Up to 31 "words" from the vocabulary list may be stored in each table location. The digitized voice vocabulary uses the latest Texas Instruments voice set, and sounds noticeably better than the first generation TI version used by many other makes of controllers. Digital Voice Recorder (DVR) track selections may be used in the voice message coding, permitting voice tracks to be intermixed with the synthesized messages. More on the optional DVR unit later. Included in the 475-word vocabulary table are also codes for courtesy tones, DTMF tones, the 16 DVR tracks, CW IDs, and control of the eight user input and outputs provided on the CAT 1000.

The Scheduler Is Included

A 60-position scheduler is included. The scheduler may be set to control various repeater functions at preset hours, days and months, and may be preprogrammed for special events a year in advance. Besides being able to control the zone channels, the scheduler can fire selected voice messages, DVR tracks, macro commands (more on these later), paging tone groups made up from Motorola two-tone sequential paging tones, and DTMF tones groups from respective 40-position tables.

Software pointers enable the programmer to select whether scheduled events (including macro or memory file loads, etc.) occur based on repeater usage. For example, you may elect to have a scheduled hourly—but lengthy—club bulletin skipped over if the scheduler command is set up to do so when the repeater is in use. On the other hand, a scheduled "must go!" net announcement, macro or memory file swap maybe programmed to occur regardless of whether the repeater is in use.

Macro Commands Link Operations

The macro commands allow several operations to be combined together. Each of the 40 table positions is given a control number (up to seven digits) that can be initiated either from the repeater or control receiver input via DTMF commands, or the macro may be initiated by the scheduler to perform a series of tasks at certain times, or by the action of one of the eight user inputs. Up to 10 macros may be included in a macro string, including the ability to cascade macros by calling another macro set as the last command.

Control Security

The CAT 1000 employs two DTMF decoders. Control may be done via the repeater input, but one decoder is used only for control commands entered via either the UHF control receiver or telephone. Telephone control takes priority over the UHF control input. All of the user functions, and control operator passwords, macro control codes, autopatch codes, etc., are easily changed and may be set up to seven digits in length.

A control operator password is needed to change or to read back the status of the channels in any of the eight zones. An unlock code is needed to "enter" the controller to do more involved programming, such as changing passwords, patch codes, or programming the macro, scheduler, autopatch, voice message, DVR or other tables.

Control operators can access the CAT via telephone, the repeater input, or through a UHF receiver link for DTMF programming. A 300 baud onboard modem allows accessing the controller through your home computer for single-line command edits. Using the optional editor program ($39), the complete set of eight DOS files can be edited at home and

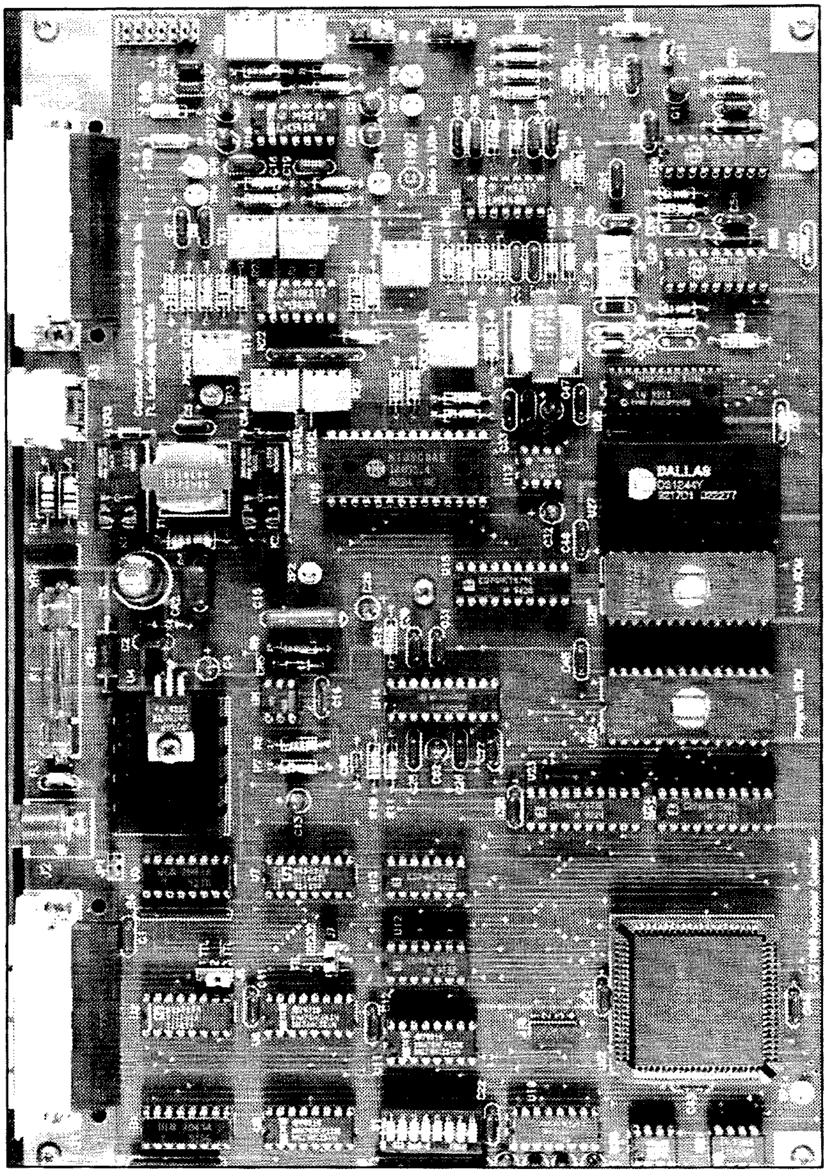


Photo A. The CAT 1000 repeater controller board.

uploaded (or downloaded from) to the CAT 1000. Modem access is password-protected. An on-site 4800 baud RS232 jack is provided. All CAT 1000 RAM memory is stored in a nonvolatile Dallas time and 64k memory chip.

Control operators, besides having the ability to easily edit the scheduler, macro and other tables, can also check the contents or status of any of the tables, timers, zone channels, auto dialer numbers, etc. in a vocalized format!

Memory Files

An extremely powerful ability of the CAT 1000 is the ability to recall any of eight preprogrammed memory files into active memory. The memory file loaded into active memory can be easily changed and restored in its new configuration. Memory files maybe recalled by repeater users, if so permitted to do so, or via scheduler or macro command strings. New memory files can be created from scratch in active memory, and then stored to the appropriate memory file. Each memory file can give the repeater an entirely new personality—each memory file contains a unique setup for the 64 control channels, 18 repeater timer values, and the 25 control codes governing the autopatch, control operator codes, speed and emergency telephone dialers. The "loading" of a memory file to active memory is completely transparent to the repeater users when it occurs.

Courtesy Tones

Courtesy tones are made up of from one to three sequential tones. The frequency, duration and spacing of the tones are selectable, and you may store the values for 10 different courtesy tones in a special table. Each of the 10 table positions is assigned a value in the 475 "word" vocabulary listing. The link or remote base COR has its own unique courtesy tone.

IDs

Two CW IDs are included. One will automatically execute if someone attempts to talk over one of the synthesized voice ID messages. The CW IDs may be selected as the primary IDs if so desired. Six different voice IDs may be preset and stored in voice message tables one through six. DVR tracks may be used as voice IDs in any of the six voice message slots allocated for these positions.

The Autopatch

The autopatch may be run open, or closed and protected with up to a seven-digit access code. A 20-position phone number lockout table is provided, and with the * wildcard all four- and three-digit numbers (***, ****) may be locked out. Another 20-position area code lockout table is provided, and again the * wild card may be used to expand the lockout features. For instance, entering 9** in this table would lock out all area codes beginning with the digit nine. The autopatch will vocalize the phone number entered in a manual autopatch operation, unless the feature is disabled.

Up to 10 emergency speed-dial numbers may be stored, and up to 300 membership phone numbers maybe stored in three groups of memory. Each memory dialing position also can be used to store and vocalize what is being autodialed; for example, the controller would say "autopatch, K1ZJH" if that information was stored along with my phone number in memory. Each of the three groups of 100 sets of telephone memory, and access to the emergency speed dial, can be protected by unique access codes. Reverse autopatch is available, last number redial and DTMF regenerated dialing or pulse dialing is also available.

User Inputs and Outputs

The CAT 1000 has eight inputs and outputs. The inputs look for a positive-going transition, and may be programmed to execute macros, voice messages, file loads, user outputs, or other controller actions when activated. The input signal levels are TTL, CMOS or supply voltage compatible. Eight open collector outputs are provided to control on-site equipment.

Other Features

DTMF muting, DTMF windows, DTMF pad test, time of day request and grandfather clock, and DTMF paging regeneration are other features of the CAT 1000. The repeater may be put into either/or DTMF or CTCSS access, with a programmable window for open access once either is detected. The ARRL LiTZ emergency alert is supported.

The DVR

The digital voice recorder has 16 soft-partitioned channels with up to two minutes of total recording time and is an option. Serial card #2 must be installed on the CAT 1000 for the DVR option. The serial card costs $59, the Ming DVR unit is $99, and the interconnecting cable is $20. Serial card 2 will supply eight additional user outputs.

Other Options

C3I, Inc. makes accessories that support the CAT controllers. One is an audio delay board (Model ADB, $94.95) that will delay the incoming receiver audio up to 150 mS. This will mask the first blip of a DTMF tone, and also eliminates the repeater squelch tail noise burst. Another C3I product is their APM board, an audio processor which sells for $43.25. The APM board allows the repeater operator to tailor the repeater audio response by either enhancing or reducing the high and low frequency passbands. C3I also provides optional enclosures for the CAT 1000. These items are available factory-direct.

Remote Base Operation and Linking

The CAT 1000 will fully support multiple radio VHF/UHF remote bases or links through a Doug Hall interface. Link serial tuning is available through serial card #1 when installed. Forty preset link frequencies can be stored in memory. Frequencies may be stored in BCD format. The CAT 1000 is also an HF remote base controller, and will directly interface to and provide full control over either the Kenwood TS440 or Yaesu 767GX HF transceivers.

CAT 1000 Manual

The CAT 1000 manual is complete, although the beginning user will most likely be lost trying to figure out all the features of his new controller. The problem is that the CAT 1000 is so powerful it is impossible to fully learn it without playing with it for a few weeks and learning as you go. There are usually several ways one can program the controller to do various tasks, due to the programming power offered by the scheduler and macro commands. Programming examples given in the manual are complete, but in my opinion a training section is badly needed to help one get started. However, should problems or questions arise, the factory telephone support is without equal.

Interfacing the CAT controllers to an existing repeater is a simple and painless task. All external connections to the outside world are done through 25-pin connectors, which include internal EMI filtering. Complete turnkey repeater systems Incorporating the CAT controllers are available from Maggiore Electronics Labs (see the sidebar).

CAT 300 vs. CAT 1000

The biggest difference between the models is the ability to support links, cross-band repeaters or remote base operation. The CAT 300 does not support these features; for a budget-minded club not needing them, it is a top-notch choice. The base price of the CAT 300 controller is $299. With the optional clock and scheduler the CAT 300 Deluxe costs an additional $99. There Is no modem, RS232 jack, or DTMF or paging tones available in the CAT 300. But, the CAT 300 does include a full-featured autopatch with 100 speed dial and five emergency dial locations.

Peripheral CAT Support Products:

C3I, Inc.
406 North Pitt Street
Alexandria VA 22314
(703) 684-1382

Turnkey Repeater Systems Using the CAT Controllers:

Maggiore Electronic Labs
600 Westtown Road West
Chester PA 19382
(215) 436-6051

Number 9 on your Feedback card

73 Review

by Michael Jay Geier KB1UM

The Yaesu FT-11R Miniature HT

Tiny gets terrific.

Yaesu U.S.A.
17210 Edwards Rd.
Cerritos CA 90701
Price Class: 1-5 watt—$369;
5 watt—$389

For several years now, ham walkies have been evolving slowly, each new radio just a little smaller and a little more sophisticated than the last model. Suddenly, all kinds of very small rigs have appeared, heralding a new generation. Evolution has given way to revolution, and the new FT-11R is a remarkable example of the trend.

Basics

Like most of the offerings from the Big Three, this radio does everything under the sun. In addition to the now-standard autodialer memories, generous memory capacity (150 of them!), CTCSS encode (decode is optional) and digital paging features, this diminutive pocketful incorporates a few new goodies: alphanumeric labels for each memory, message paging, and knobless volume and squelch adjustment.

With the supplied 4.8-volt battery, power output is 1.5 watts, which is less than you usually get with full-sized HTs but in line with many other miniature rigs. It should be enough for most repeater operations. But, if you need more power, higher-voltage batteries will get you all the way up to 5 watts out, which occurs at 9.6 volts DC input. And, you can get an AA-cell holder, so you'll never be out of power in a pinch. Naturally, the rig will get bigger with a larger pack hanging out the bottom. Although the radio is rated up to 12 volts, that really means 12 volts in this case, not 13.8 to 15 as is commonly found with car power. Consequently, there is no direct DC input jack; a special adapter is required to run this radio from your car's electrical system or an external supply. The adapter is pretty slick, though—it's a cradle which includes an 11-volt regulator and a cooling fan. Most of today's HTs will put out 5 watts, but they'll get so hot you can't hold them. The fan should keep this one a lot cooler. By the way, most of the new mini-rigs are limited on how high an input voltage they can accept, and few can take direct car power. Like this HT, they use power FET transmit final amp modules, which are very efficient at low voltages but just can't tolerate the higher voltages.

This baby is smalll At about 4" x 2-1/4" x 1", the whole thing fits into the palm of your hand. Many of the small radios increase their total internal volume by being somewhat thick. Not this one; its one inch is about the slimmest depth I've ever seen on any HT.

The front of the rig has a fairly large display, a BUSY/TX LED, an 18-button keypad, and two more buttons for controlling the volume and squelch. All 20 of the buttons are large and have good tactile feedback, and they're all backlit by green LEDs, along with the display. Also, there's a lever which lets you lock the rig's controls to prevent accidental operation. On the side are the usual rubberized PTT, lamp and monitor buttons. The power on/off button is electronic and is located there, too. On top are the antenna connector, the mike and earphone jacks, and the dial knob. That knob is the only one on the entire rig!

The antenna is exactly the same length as the radio, which is convenient for stuffing the whole works into a little calculator case or something similar. The duck is very stiff, though. But it works fine.

The included 600-mAh nickel-cad pack fits very securely on the back of the radio, which is a stark contrast to some of the other new mini-rigs with "nesting"-style batteries. There's no way you could accidentally cause this one to fall off. In fact, even deliberately pulling it off requires some effort.

The Goodies

The most impressive new feature is the memory capacity. In normal, numeric readout mode, you get 150 memories, which is great because this radio makes a dandy VHF scanner, too. Actually, as delivered it only covers the 2 meter ham band. But, with a simple series of button presses, which are described in the manual, coverage increases quite a bit, to 110-180 MHz receive, with an AM detector automatically engaged below 136 MHz for easy listening to the aircraft band. Transmit is still limited to 144-148 MHz, though. Naturally, MARS/CAP mods are available for permit holders.

You can also choose alphanumeric mode, which lets you label each memory with a six-character name. In this mode, memory capacity is reduced to 75, but who really needs more than that on a single-band HT? The alpha mode is great if you live near lots of repeaters or travel a lot. No longer do you need to remember that 145.470 is downtown and 146.850 is west. Just call them DWNTWN and WEST!

Along with the now-common but rarely-used DTMF squelch, this radio offers message paging. In this mode, you can send and receive up to 10 sets of six-character mes-

sages. You can also store up to 10 of these for future transmission. The last 10 received are stored for your later perusal. There's no mention of whether or not another message-paging-capable rig is required to send you messages. If not, that would let you be paged by anyone with a DTMF pad. Either way, though, this scheme, like all DTMF schemes, has very little usefulness in the U.S. because most repeaters won't pass DTMF tones; they deliberately block them to prevent jammers from decoding autopatch codes.

Where the alphanumeric system really shines, though, is in its application to the autodialer. Yep, each autodial memory can be named. This is seriously handy. Many times I've entered phone numbers into my rig, only to forget later whose they were. That won't happen with the FT-11R. After all, who can forget names like "Mom," "home" and "Jim"?

In addition to all the memories, there are two VFOs, A and B, and every memory can be tuned like a VFO. The memory management scheme is essentially the same as on all the Yaesu HTs since the FT-411, and it's perhaps the simplest, best-developed system in the industry. Unless you've never used any HT before, it won't take you very long to master the major features of this radio.

I was initially thrown that such a full-featured rig didn't include automatic repeater shift. Then I discovered that it is there, but you must turn it on. Unlike most HTs which offer it, this one's default settings leave it off. It's no big deal, though; you just turn it on once and forget it.

Who Needs Knobs?

What happened to the volume and squelch knobs? On this radio, both functions are controlled by two buttons on the front panel. Pressed alone, they turn the volume up and down. If you press the function button first, they adjust the squelch. On the display, a little vertical bar graph shows the current setting. It seemed odd at first, but I soon found I really liked this idea. There's no way the settings can get disturbed while the rig rides along in your pocket, purse or briefcase, and the bar graph makes it easy to see the setting. If you prefer, though, you can set the dial knob to duplicate the functions of the volume/squelch up and down buttons. But once you do that, you can't use it to tune the rig or select memories anymore; you must use the up/down tuning buttons (which are not the same as the volume/squelch up/down buttons).

On The Air

The receiver is very sensitive and particularly selective. There's no mistaking when you're 5 kHz off, because the audio gets so distorted you can't stand to listen to it. That suggests that the IF filtering is extra-sharp. Also, a glance at the schematic reveals a front end with several stages of voltage-tracked tuning, which should really help reduce intermod, at least as far as a tiny radio with no large front-end filters can. The receive audio is fairly good as long as you keep the volume down. Included in the box was a little slip of paper noting that the audio will distort if played at high volume levels. In truth, it distorts even at moderate levels. The intelligibility is still good, but I've heard other radios in this size class which sounded significantly better.

"... for a 'drop in the pocket and go' handheld, this is the best one I've seen yet! It's a real winner..."

The transmit audio, though, is wonderful. In fact, it's even noticeably better than the already-good audio on my bigger HT. There's no obvious microphone hole, so I was worried at first, thanks to a previous experience with another rig which used a hidden mike. But this one works like a charm, however they're getting the sound to the mike element.

The Documentation

The radio comes with a full schematic, and the manual is very well written. I would point out, however, that the section on CTCSS makes it sound as though the optional FTS-26 tone module is required for any CTCSS operation. In fact, encode, which is the most useful part, is standard; only decode requires the module. A plasticized-paper "cheat sheet" booklet is provided, and it's quite detailed. In keeping with the size of the radio itself, the booklet is very small, so you will be sure to put it in your wallet or purse.

What I Liked

There's a lot to like in this little gem. It's really small, it works well and it's easy to use. The alphanumeric memory and autodial systems are very handy. The rig is quite solid, despite its comfortably light weight. The display is large and shows lots of information, including the final zero on the frequency. Even with the alpha mode engaged, the memory capacity is more than generous, and there are two sets of subband limits provided for versatile scanning.

The battery is charged by snapping it into a little stand, which then plugs into the wall charger. Cleverly, this stand lets you insert the battery with or without its being attached to the radio. So, unlike with many mini-rigs, you can use this radio with another battery while the first is charging. To me, that's essential.

What I Didn't Like

The few nit-picks I have on this radio are pretty minor. The receive audio could be improved. Also, the viewing angle of the LCD is unusually sharp, requiring you to look from above the radio. Especially at night with the lamps on, you can't see the display from below, and it looks washed out even when viewed straight on. Finally, the lamps don't stay on just because you keep pushing buttons; they go out after about five seconds anyway. You can, however, lock them on, which is great for base or mobile operation with an external power supply.

Conclusion

If you want a really small HT, check this thing out. If I were contemplating using one radio for base, mobile and HT operations, I'd probably select something bigger with direct DC input. But, for a "drop in the pocket and go" handheld, this is the best one I've seen yet! It's a real winner, and I'm not looking forward to sending it back.

The Challenge of 1750 Meters

No license required.

by David Curry WD4PLI/6

1750 meters is a hobby, just like amateur radio. In fact, it is much like old-time amateur radio; it separates the men from the boys! In the early days of radio, hams built their own equipment, and most operators did not even have licenses. 1750 meters is still true to that theme: "No license required, only skill desired."

Unfortunately, 1750 meters is a noisy, sometimes crowded, band filled with carriers and modulations. Well, guess what? Many of those carriers and modulations are European long-wave broadcast stations DXing over the Atlantic, and perhaps that code you hear in the background is actually a Lowfer sending his ID beacon. FCC rules limit transmitting antenna length to 50 feet and DC input to the PA to 1 watt. Even with these restrictions, surprising distances via ground-wave propagation occur regularly. Using a common noise blanker, audio filter, or even a phase-canceling device, an operator can clean up the band of light dimmers and power line noise that often can be discouraging. Simple receiving antennas such as an active whip or loop placed in a clear area and using a "virgin" ground (a separate, isolated ground that carries no power-line noise) can provide unimpeded reception.

Considering that communications technology has become so advanced, there is no reason why you can't enjoy the fun and challenge of 1750 meters just because the major ham manufacturers didn't include it in their rigs. Build your own radio, perhaps with a friend, and get on the air; it's that simple. You will find that you have more to talk about than the weather, and you'll share in the amazement of how a 1 watt signal can travel hundreds of miles under good conditions. Many hams can use their preexisting vertical ham antenna for 1750 meter operation using a loading coil at the base of the antenna. Most 160 meter antennas are ideal for work on 1750 meters.

1750 meters was originally set aside by the FCC as a frequency range for garage-door openers back in the early '60's, but as time passed, experimenters (many of them hams) found surprising success despite FCC limitations. These "experimenters" are referred to as "Lowfers," and are on virtually any day of the week. I can hear two or three of them on my TS-430S, loud and clear, from as far away as San Diego, 150+ miles away from my Burbank, California, QTH. In Hawaii, using a portable loop antenna, Sheldon Remington received Lowfer beacons Z2 and later H2, both located in California, over 3,000 miles away! SSB, AMTOR, RTTY, and packet have all been used successfully.

Design

Described here is a simple "introductory" CW two-way radio for 1750 meters. Antenna dimensions for 1750 meters can be found in *73 Magazine*, September 1991, in "Dual-Band Vertical" (for 160 and 1750 meters), page 38. Also of interest is "Noise Reduction Using Broadband Active Whip Antennas," *73 Magazine*, October 1992, page 38.

Please note Figures 1 and 2. The front-end preselector uses a tunable two-pole Chevychev bandpass filter to reduce unwanted signals, such as GWEN (Ground Wave Emergengy Network). The direct conversion receiver is an uncomplicated design using the NE602 chip. The NE602 Colpitts VFO provides the frequency reference for the transmitter section. The VFO can be PLL-controlled externally, facilitating CCW (Coher-

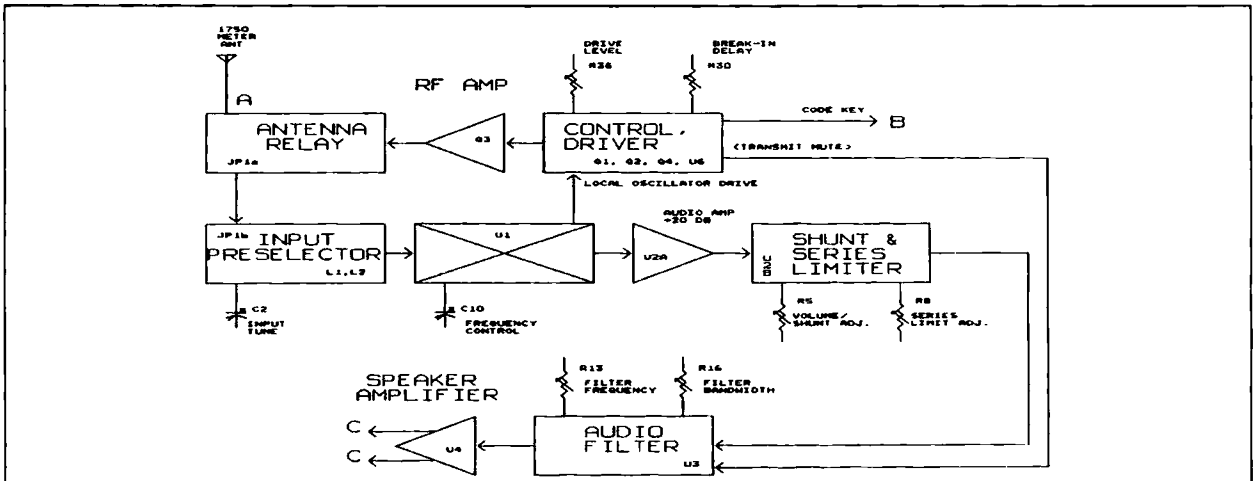


Figure 1. Block diagram.

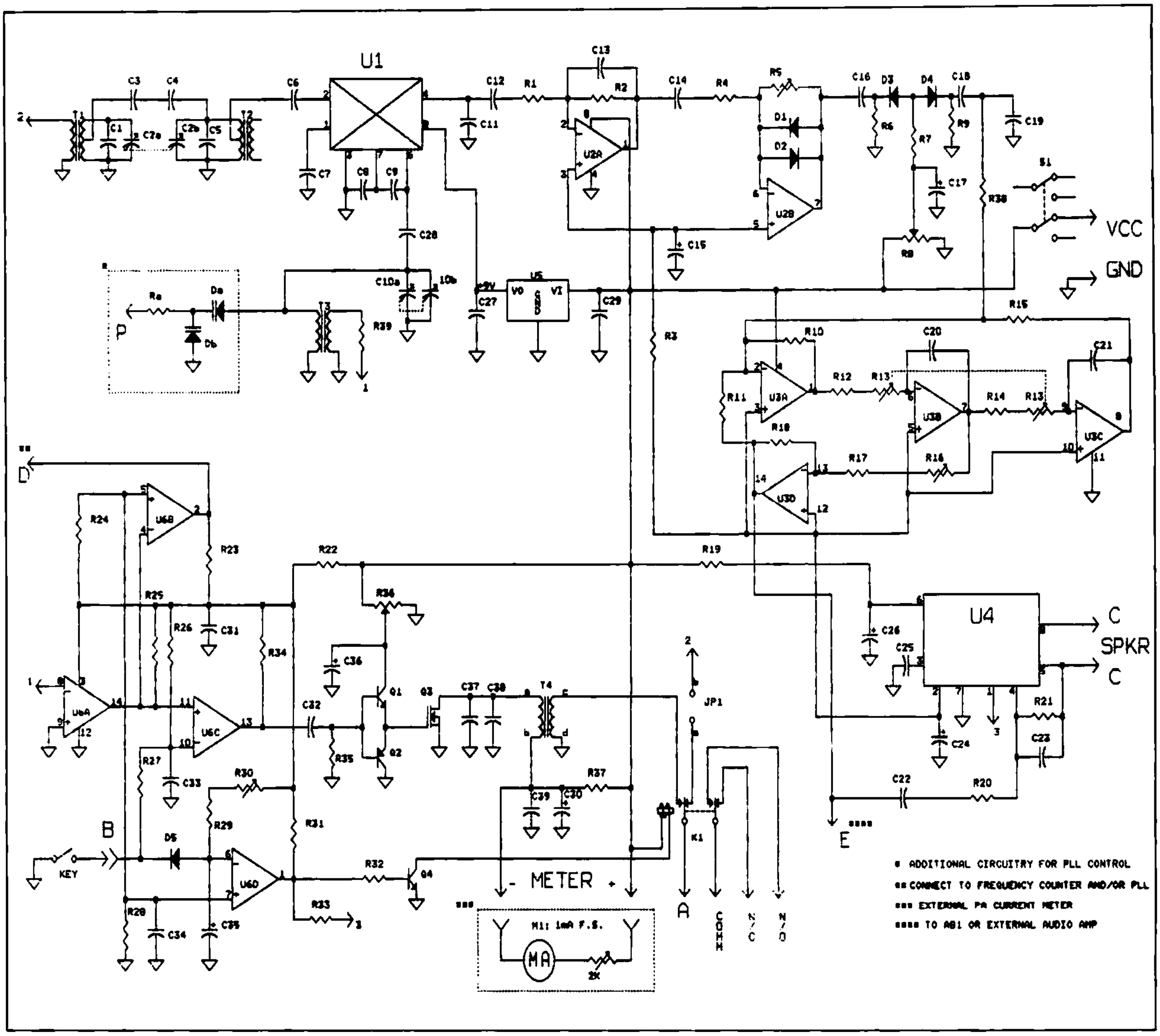


Figure 2. Schematic.

ent Continuous Wave) operation.

Noise is always a problem at these frequencies so two noise limiters are included to provide very effective limiting of high-amplitude man-made noise and static. A shunt limiter followed by a series limiter is used in this design, and this is superior to most designs found in commercial and military receivers. Audio filtering is included, with variable frequency and bandwidth control for precise filtering of the desired signal.

Ample audio output drives headphones and most speakers. This rig is capable of providing over 100 dB of gain with virtually no power supply hum. The transmitter section samples the VFO using a simple logic circuit, controlling the duty cycle and the keying of the amplified signal. The signal then drives a class E power output stage. This class of service is a very efficient 96%. Many thanks go to Mark Mallory for his excellent research into efficient class-E amplifiers and for sharing his information.

The transmitter section lends itself as an excellent beacon transmitter. Simply apply the beacon message to the code key input for reliable beacon transmission. As you probably know, purchasing components these days can be expensive; this was a major concern during the design of this project. All parts are "off the shelf," with the ordering part number given.

Beware: Simple "one-transistor" transceiver designs just do not work on 1750 meters. Don't be fooled!

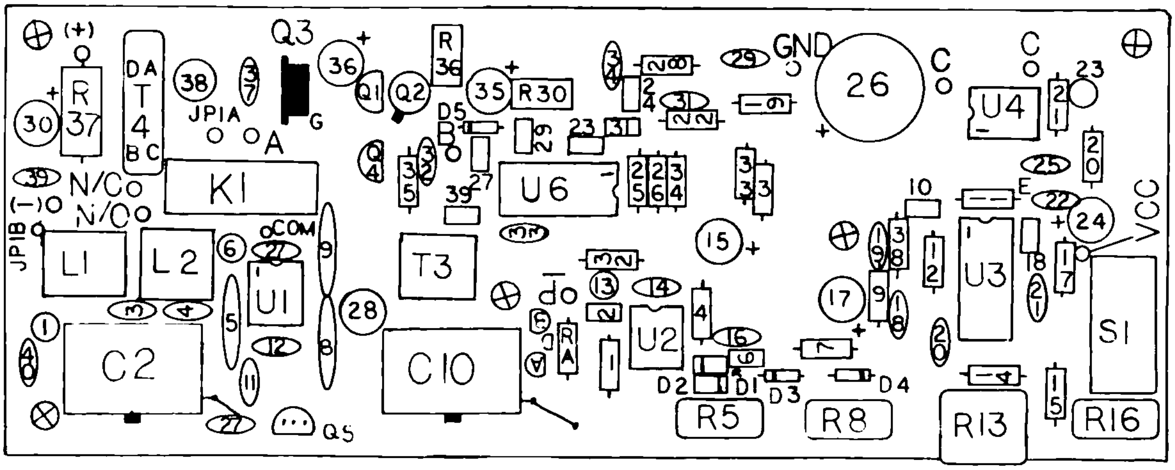
Construction

Please note the component layout (Figure 3). You will notice that several component leads are soldered directly to the component side of the circuit board. This provides the ground connection for these components. When this occurs, be sure to solder the component lead to the ground plane *and* on the solder side. Note that capacitors are disc-shaped, while electrolytics are round and have the polarity marked. Transistors are designated by the half-moon shape, or round with a key. ICs are rectangular, with the "U" mark at the end.

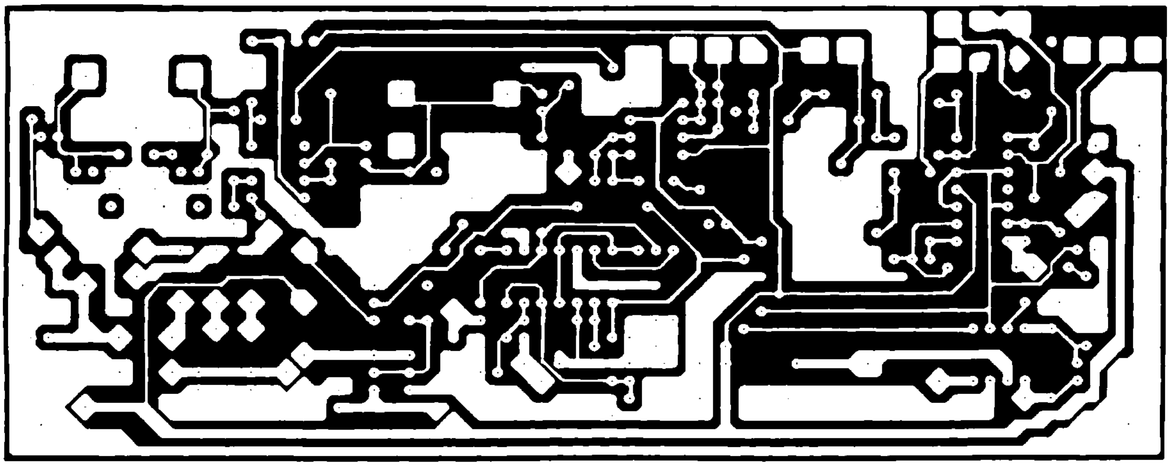
I recommend soldering the ICs first. Notice that some pins must be soldered on the component side.

Next, solder transformers T1, T2, and T3. Dab some solder on the side of the transformer and ground plane to ensure a good ground.

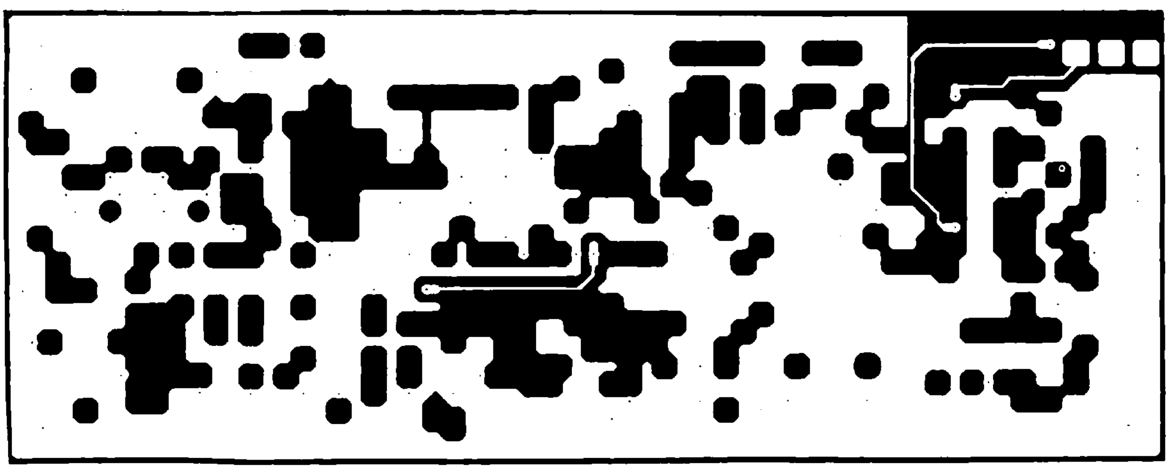
Install all the capacitors, followed by the variables C1 and C10. C1 and C10 should be installed so that the side with five leads goes through the circuit board. Pull the leads firmly and bend at a 45-degree angle to hold while soldering. Note the small horizontal lead sticking out on the side of C1 and C10. Solder a wire from that lead through the hole in the circuit board under it.



a)



b)



c)

Figure 3. Double-sided PC board: (a)parts placement diagram, (b) top foil pattern, and (c) bottom foil pattern.

Transformer T4 must be wound by hand. Wind the turns evenly and firmly. After you are finished winding, cut the wires so that about 1" remains from the toroid to the end of each wire. Remove the enamel insulation from the 1" ends with sandpaper. The sidebar has all the winding information you will need. Notice that the holes for T4 are marked "a & b" for the primary, and "c & d" for the secondary. They crisscross on the circuit board. Use an ohmmeter to make sure the wires don't get mixed up and the secondary wind doesn't accidentally go into the primary holes!

Now solder the remaining components. Resistors installed horizontally are indicated by a rectangle shape, while vertically-mounted resistors are a small square. Any vertical resistor with a lead going to the ground plane should use the longer lead as the ground lead. You may decide to "go all the way" and install your transceiver in a box or chassis. The LMB box listed in the optional component list is a good choice. It provides extra room for a speaker, meter, or antenna switch. The meter is both a luxury item *and* a necessity. To make a nicer finish for the front of the chassis, templates for the front and rear face plates are provided in Figure 4. Go to a photocopy store and copy them to a transparency. Be careful not to scratch the black from the transparency.

Apply a thin film of clear epoxy glue over the front of the box. Size up the transparency so the top of the box on the transparency is even with the top of the chassis. Be sure you can *read* the transparency before pressing the transparency to the adhesive. After the epoxy has cured for a few hours, cut away the excess transparency around the box with a sharp knife. Tap and drill each hole to a size a little larger than each control shaft to give some play. Repeat the same procedure for the rear chassis face plate. Use 4-1/2" aluminum spacers between the bottom of the circuit board and the floor of the chassis, and four 4/40 nuts and bolts to secure the board.

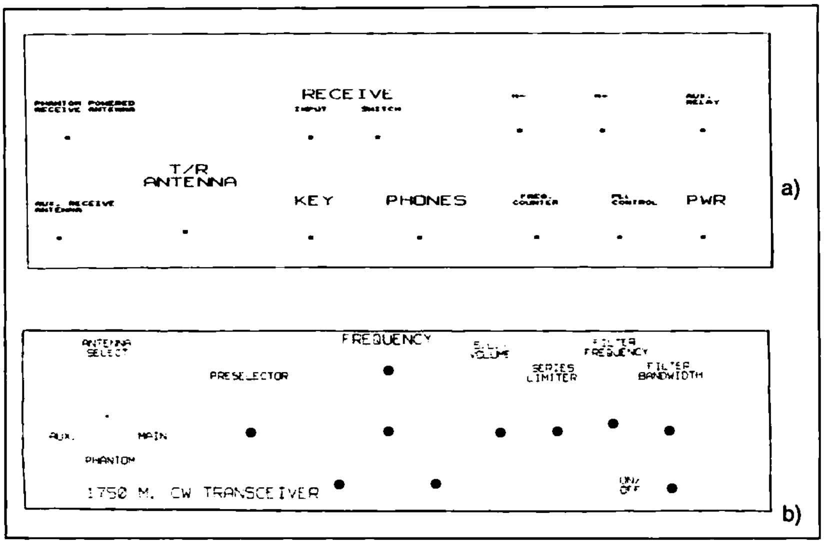


Figure 4. Face plate templates: (a) front, and (b) rear, reduced 50%.

T4 Winding Data

Power	C37	C38	VCC	T4a/b	T4c/d	Form
1 watt*	X	N/A	12 VDC	93 Turns #30 Ga.	49 Turns #24 Ga.	T-68-3
3.5 watt**	N/A	X	12 VDC	49 Turns #24 Ga.	48 Turns #24 Ga.	T-68-3
10 watts	X	X	18 VDC	33 Turns #20 Ga.	37 Turns #20 Ga.	T-130-3

N/A: Not used.
* Heat sink recommended.
** Heat sink required.

Formulas for Calculating Efficient PA Design

L: Tank inductance — C: Tank capacitance
Z: PA load resistance — V: VCC supply voltage
F: Operating frequency — P: Output/input power

$$L = \frac{.2085 \times V^2}{P \times F} \qquad C = \frac{1}{(2 \times pi \times 1.2915 \times F^2) \times L} \qquad Z = \frac{1.2638 \times V^2}{P}$$

T4 Inductance & Turn Ratio Formulas

T-68-3: Number of turns = $100 \times \sqrt{(\text{Inductance in uH}/195)}$

T-130-3: Number of turns = $100 \times \sqrt{(\text{Inductance in uH}/350)}$

To match the impedance at the drain of Q3 to a 50 ohm impedance, you will need to know the turns ration (Tr):

$$Tr: \sqrt{(Zd/Z1)}$$

Zd: Drain resistance — Z1: Load resistance (usually 50 ohms)

These formulas are included to help solve any particular matching requirement. The above table can be used to match most requirements.

The frequency value for "F" can work for frequencies +/- 10 kHz.

Calibration

Connect the antenna, power supply, etc. to these points:

- A—50 ohm transmit antenna port.
- B—Code key port. Transmit is initiated when point B is grounded.
- C—Both points marked "C" are connected to 8-32 ohm speakers or headphones.
- COMM—Common terminal for auxiliary relay.
- D—Frequency monitor port. CMOS level square wave output connects to frequency counter and/or PLL input.
- GND—Connect power supply negative or ground to this point.
- JP1—Receive input select. Short JP1a&b to use antenna at port "A" for receive. RECEIVE ONLY antennas connect to JP1b.
- N/C—Normally closed terminal for auxiliary relay control.
- N/O—Normally open terminal for auxiliary relay control.
- P—PLL or phase control of VFO. Section normally not used.
- VCC—12-18 volts, filtered DC or battery to the terminal.

Connect 12 volts of power to VCC points. A frequency counter or receiver covering 150 kHz to 250 kHz will be required.

Connect the frequency counter to point "D." Turn the transceiver ON. Turn the tuning capacitor C10 maximum clockwise. Turn the slug in T3 until the frequency reads 189 kHz. If no frequency counter is available, use a long-wave receiver, general coverage receiver, or ham radio that can accurately tune to 190 kHz. Place a small piece of wire from the receiver antenna input near U1. Tune the receiver for a center frequency of 189 kHz. Listen for a tone while turning the slug of T3. Slowly turn the slug until you hear a zero beat on the receiver. Next, align the preselector. T1 and T2 must be tuned to the same frequency. If you have a signal

generator, place a low-level (approximately 100 μV) signal of 175 kHz to the input at JP1b. On the transceiver, turn the Preselector and the Filter Frequency controls to the 12-o'clock position. Rotate the series limiter and the filter bandwidth controls to full counterclockwise.

Tune the Frequency control for 176 kHz.

Turn the slugs on T1 and T2 for maximum volume, decreasing the signal generator output as the tone becomes louder. If no signal generator is available, connect the antenna to JP1b and listen for any carriers by adjusting the Frequency dial and volume controls. Turn the Preselector capacitor to the same setting as the Frequency capacitor. Turn the slugs in T1 and T2 for maximum signal strength.

Operation

The Volume control will limit the amplitude of all signals past a certain point. This can be used to increase the gain of a desired signal that is buried in man-made noise, cutting off the peaks of the noise while leaving the signal unaffected. The series limiter can be used to lower the volume when the volume/shunt limiter control is used for extreme limiting. You will find that the volume/shunt limiter is better at reducing high-level man-made noise, while the series limiter is better for reducing static and occasional high-impulse noise. The audio filter frequency and bandwidth are adjusted for the desired amount of filtering.

An important feature is the input Preselector control. The preselector filter is very sharp, allowing only a small slice of the band to be received. If, for example, the beacon you want to hear is on 180 kHz, tune the Frequency control for a frequency of either 179 kHz or 181 kHz. The beacon message will be heard at a 1 kHz tone: 180 kHz-179 kHz = 1 kHz, or 181 kHz-180 kHz = 1 kHz. The preselector must be tuned to the desired signal at 180 kHz for maximum pickup. Choosing whether the upper or lower VFO frequency is best depends on which provides the clearest reception. An example of two-way operation could be you transmitting on 182 kHz with the preselector peaked to your friend's frequency of 182.4 kHz. Your friend's preselector would be peaked to your frequency of 182 kHz. As you can see, tuning the preselector above and below your center frequency provides a lot of flexibility.

Transmitting a beacon is very useful while you're not on the air. It is especially helpful to other stations that want to know if they can hear you or not, and helps with antenna testing and band conditions. The transmitter is easy to use. Simply connect your beacon ID or code key or PK-232 CW to the key input. Adjust your time-delay potentiometer (R30) for the desired time delay. The PA drive control (R36) can be set for maximum VCC. The transmitter was designed for link or tap coupling, using 50 ohm coax from the transceiver to the antenna loading coil. Direct connection from the cold end of the loading coil to the secondary of T4 is fine.

A 1 mA meter may be used to monitor the PA current. However, meters can be expensive; you can use a VOM or VTVM instead. Connect this to the meter "–" and "+" points on the circuit board. The voltage indicated is the input current to the PA. 1 watt of input power is 83 mA at 12 volts, or 83 millivolts on the VOM or VTVM. Also remember to measure the PA voltage at the "-" meter point since there is a slight voltage drop across R37 when calculating input power.

Parts List

Part #	Description	Purchase
C1,C5	470 pF poly cap	Mouser: 23PS147
C11	0.047 µF film cap	Digi-Key: P4521
C13,C23	0.001 µF polystyrene cap	Mouser: 23PW210
C15,C17,C24, C30,C35,C36	10 µF/50 VDC elec. cap	Mouser: 140-XRL25V10
C18,C25,C31,C39,C27	1 µF monolithic cap	Newark: 90F1907
C19,C33	0.01 µF disc cap	Mouser: 140-CD50Z6-103M
C2,C10	400 pF tuning cap	Mouser: 24TR218
C20,C21	0.018 µF poly cap	Digi-Key: P3183
C26	2200 µF/16 VDC electro cap	Mouser: 140-XRL16V2200
C28,C38	0.01 µF polystyrene cap	Mouser: 23PW310
C3,C4	7.5 pF NPO disc cap	Mouser: 21CB008
C40	0.022 µF poly cap	Digi-Key: P3223
C6	0.0047 µF poly cap	Mouser: 23PW247
C7,C12,C14,C16,C22, C29,C32,C34	0.1 µF ceramic disc cap	Mouser: 140-CD12U6-104M
C8,C9,C37	0.0027 µF polystyrene cap	Mouser: 23PS227
D1,D2,D3,D4,D5	Diode	Mouser: 592-1N914A
K1	DPDT relay	Digi-Key: Z768-ND
Q1,Q4	2N2222A NPN transistor	Mouser: 511-2N2222A
Q2	2N2907A PNP transistor	Mouser: 511-2N2907A
Q3	Power MOSFET	Mouser: 511-IRF510
R1,R4,R20	3.3k ohm 1/4W	IME
R10,R11,R15	100k ohm 1/4W Metal 1%	Mouser: 29MF250-100k
R12,R14	4.02k ohm 1/4W 1% metal	Mouser: 29MF250-4.02k
R13	10k dual audio taper pot	Calrad: 25-396
R19,R22	12 ohm 1/4W	IME
R2	33k ohm 1/4W	IME
R23,R32,R33,R34	1k ohm 1/4W	IME
R25	560 ohm 1/4W	IME
R3,R7,R21,R29, R35,R38	82k ohm 1/4W	IME
R30	250k ohm PC trimpot	Mouser: 32RM503
R31,R39	2.2k ohm 1/4W	IME
R36	2k ohm PC trimpot	Mouser: 32RM302
R37	1 ohm 1W	Mouser: 29SJ901
R5,R16	500k ohm PC pot	Mouser: 31CW505
R6,R27,R28	6.8k ohm 1/4W	IME
R8	10k ohm PC linear pot	Mouser: 31CW401
R9,R17,R18,R24,R26	10k ohm 1/4W	IME
S1	DPDT PC switch & knob	Digi-Key: EG1003-ND
T1,T2,T3	0.63mH transformer	Digi-Key: TK1201
T4	Toroid transformer	Amidon: T-68-3
U1	NE602 mixer/amp	Digi-Key: NE602AN
U2	Low-noise op amp	Mouser: 511-LF353N
U3	Quad op amp	Mouser: 511-LF347N
U4	Audio PWR amp	Newark: MC34119P
U5	+9 VDC regulator	Mouser: 333-78L009AP
U6	Quad comparator	Mouser: 511-LM339AN

Sources:
Mouser Electronics—(800) 346-6873
Digi-Key Sales—(800) 344-4539
Calrad—(213) 465-3504
Newark Electronics—(818) 888-3718
Amidon Associates—(310) 763-5770
IME—(817) 473-1730

A drilled and etched PC board is available for $22 plus $3 S & H; and this project is available in a complete kit for $89 plus $3 S & H from: Curry Communications, 737 N. Fairview St., Burbank CA 91505; (818) 846-0617. Brochures are available; send SASE.

HAMSATS

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Amateur Radio Via Satellites

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Houston TX 77083-5640

Interest in the amateur-radio satellite program has increased rapidly in recent years. Today we have analog satellite transponders for CW, SSB and FM, and digital satellites running 1200 and 9600 bps (bits per second) AX.25 packet. Equipment manufacturers are designing and selling more radios conceived specifically for satellite operation. Current articles and books have surfaced to help enthusiasts get on the air. News of the amateur satellite programs has been brought directly to current and future satellite chasers through club talks, conventions and operating events.

AMSAT (The Radio Amateur Satellite Corporation) was prominent at the Dayton Hamvention in April and the ARRL (American Radio Relay League) 1994 National Convention in June at the Arlington Convention Center in North Texas. Field Day provided many hams an opportunity to try satellites from remote locations. Participation was very high this year. Most satellite transponders were packed for the event. Bringing it all together is the AMSAT 25th Anniversary Annual Meeting and Space Symposium this October. The gathering promises to have a record attendance as work progresses with the Phase 3D project, the largest and most versatile amateur-radio satellite ever.

Photo B. AMSAT VP of Operations, Keith Pugh W5IU, demonstrates tracking software in the AMSAT booth at the convention.

AMSAT Presentations

Whether the event is a local club meeting or the ARRL National Convention, AMSAT has a message to send to the amateur-radio community: Work on Phase 3D is progressing rapidly. This satellite represents the largest, most complex and versatile hamsat to date. A matrix of computer-controlled receivers and transmitters covering ham bands from HF through the microwaves will be attached to solid-state amplifiers and high-gain spacecraft antennas. The result is to be a satellite at least 10 times more powerful than the popular AMSAT-OSCAR-13, and with many more bands in use from space. The program is international, proceeding well, but is still in need of further funding.

Several AMSAT volunteers came to the ARRL convention in early June to present the case for Phase 3D. AMSAT President Bill Tynan W3XO could be found at the AMSAT booth or in the AMSAT forums on Saturday and Sunday. He talked to the standing-room-only crowd about AMSAT's participation in the Phase 3D project and the future of the organization.

Keith Baker KB1SF, AMSAT VP of Strategic Planning, described project details and how all the pieces fit together. Phase 3D does not represent the first time an internationally-supported hamsat has been built, but does embody the largest joint project with several new groups participating. Keith is also known for his work on *How to Use the Amateur Radio Satellites*. Now in its fourth edition, this AMSAT publication provides vital data and operating information on all current amateur satellites. It also contains information on Phase 3D, other future satellites, and a glossary of terms associated with hamsats. The booklet is available from AMSAT at (301) 589-6062, or you can write to 850 Sligo Avenue, Suite 600, Silver Spring MD 20910.

Photo A. AMSAT VP for Strategic Planning, Keith Baker KB1SF, discussed key facets of the Phase 3D satellite program at the ARRL National Convention in Arlington, Texas.

Keith Pugh W5IU, AMSAT VP of Operations, spent a good deal of time demonstrating AMSAT satellite tracking software and answering questions. Keith has been a volunteer AMSAT supporter for many years and has promoted the satellite program at many ham radio conventions in the Southwest. Several AMSAT area coordinators attended the convention and helped with the AMSAT booth and talks.

The North Texas Section of the West Gulf Division of the ARRL worked in conjunction with the Dallas County REACT organization to put W1AW/5 on the air from the convention center. The REACT group had their mobile communications center at the site, complete with satellite rigs and antennas provided by Don Gwynne K5EVI. This was the second time W1AW has been to the Arlington HamCom. The first was in 1989 for the League's 75th Anniversary Celebration in 1989.

Field Day 1994

For many years the ARRL has offered a 100-point bonus lo participating Field Day stations for making one satellite contact during the event. This year was no different but due to the large number of active hamsats some groups discovered that the satellites can offer a significant number of contacts and thus enhance their overall score. The satel-

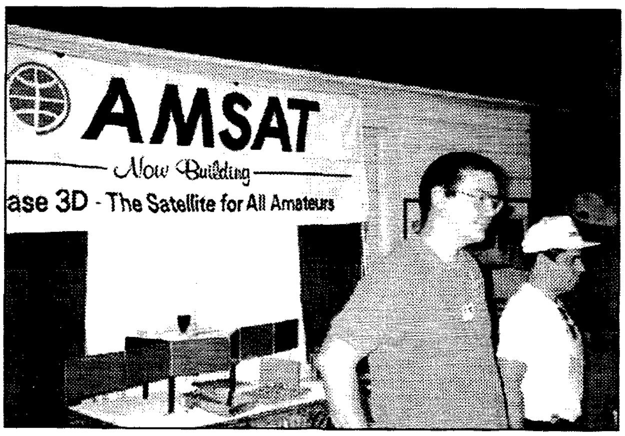

Photo C. With the small model of Phase 3D in the background, Keith Berglund WB5ZDP and Randy McKinney N5SVW answer questions at the AMSAT booth.

Photo D. Checking out the satellite antennas at the ARRL convention with Bob N5LCO.

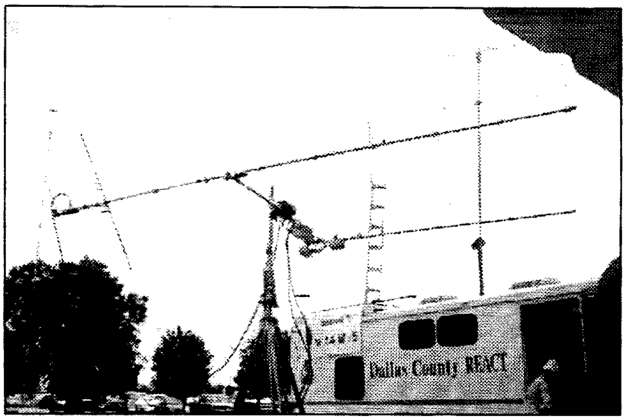

Photo E. W1AW/5 was on the hamsats from the convention site thanks to K5EVI and the Dallas County REACT team.

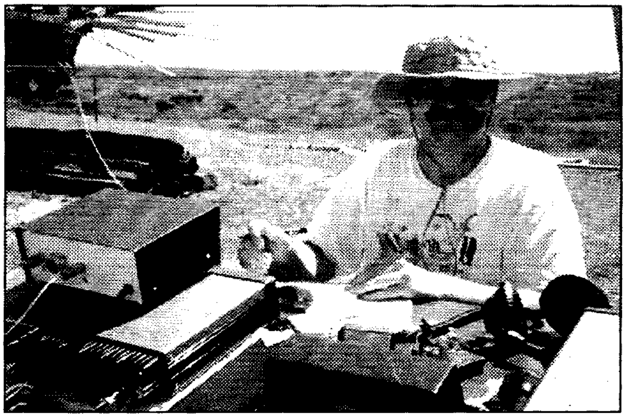

Photo F. Bob N5LCO working A-O-13 from the central Texas Field Day QTH of K5ERP (Effective Radiated Power).

lite station is "free." It does not add to the transmitter class total.

AMSAT supporters have found Field Day to be an opportunity to promote this expanding facet of the hobby. Setting up a satellite station in the field is not as simple as putting an HF station on the air, but it's getting easier all the time. To make a few contacts via the Russian RS-10 satellite, only a 2 meter transmitter capable of CW (some FM rigs do fine) and an omnidirectional antenna are needed for the uplink, while any SSB 10 meter rig can listen for the downlink.

The single-channel FM satellites, AMSAT-OSCAR's 21 and 27, were available, but due to the large number of stations trying to make contact, it was impossible to make very many per pass on these low-orbit satellites. High-power and directional antennas were a necessity. The congestion was almost comical at times and points out the advantage of the linear transponders that allow many stations to utilize the satellite simultaneously within a passband of frequencies.

A-O-13, in its high-elliptical orbit, was heard and worked by many during Field Day. For others, though, the veteran satellite A-O-10, was preferred. A-O-10, while uncontrollable due to the failure of the on-board computer many years ago, was in a good position and in great condition for early Sunday morning. Signals were excellent from both, and contacts were easy for the well-equipped.

AMSAT sponsored its own form of Field Day. The rules were a bit different from those of the ARRL. Each satellite represented a separate band, and special rules applied for messages sent via the digital birds. The winner of the 1994 AMSAT Field Day competition will receive a special plaque at the AMSAT General Meeting in October. This contest will continue in 1995 with amended rules to enhance efforts via the digital satellites and provide added incentives for operation via different modes on the same satellite. Some groups may find multiple satellite stations necessary to cover all the options next year.

The AMSAT Meeting

Mark your calendars for the AMSAT 25th Anniversary Annual Meeting and Space Symposium. The event starts Friday October 7 and continues through Sunday October 9. The site this year is the Holiday Inn at the Orlando, Florida, International Airport. It is adjacent to the Phase 3D Spacecraft Integration Facility.

This is your chance to hear all about the Phase 3D project and actually see the progress on the flight hardware. Many papers will be presented at the symposium on Friday and Saturday. Topics to be covered include all phases of amateur satellite operations.

Very reasonable rates have been obtained at the Holiday Inn; for singles or doubles the cost is $58. Call (407) 851-6400 to make reservations. Be sure to mention the AMSAT rates. To register for the symposium or to get further information, call AMSAT at (301) 589-6062.

The Orlando area has much to offer, including NASA's Cape Canaveral Visitor's Center and the Disney World complex. If you have been active on the satellites, this event is an opportunity to meet with many of the folks you have contacted. It is also a great occasion to ask questions of the AMSAT Board of Directors and find out where we are headed. See you in Orlando!

Photo G. The satellite rig collection at the K5ERP Field Day site.

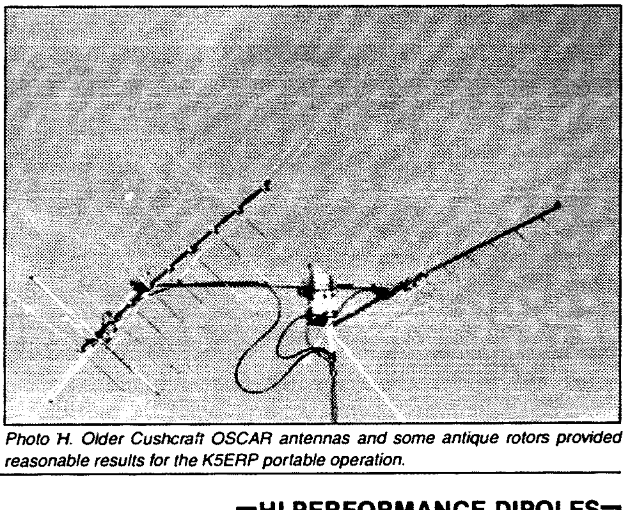

Photo H. Older Cushcraft OSCAR antennas and some antique rotors provided reasonable results for the K5ERP portable operation.

Number 12 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

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Several months ago, I mentioned one of the programs on the fifth disk in the "RTTY Loop" collection, PacketPeT Lite. This is a shareware version of PacketPeT, a versatile multitasking program for the radio amateur running RTTY on the PC.

A look at the features of PacketPeT will give you an idea of just what it can do. This Windows-based program was compiled with the Borland style controls, giving consistency to windows and control functions. Several copies of PacketPeT can be running at the same time, supporting several TNCs, if you have the ports available. It can even run in the background, notifying you of incoming traffic.

This program will run with most hardware TNCs, including, among others, the "standard" TAPR TNC2, the AEA PK-88 and PK-232, and the Kantronics KAM. It requires a PC compatible with a 286 or better processor, at least 2 Mb of RAM, at least 2 Mb of space on the hard drive, a VGA display, Microsoft Windows 3.x or OS/2 version 2.x, and a hardware TNC, such as the TAPR TNCs, AEA PK-232, or Kantronics KAM. While not required, a mouse or trackball makes using the program much easier.

The program installs with the rather standard Windows Setup type routine, and creates its own Program Manager group, with icons for each "flavor" of TNC. A supplied password is required, along with your call, for the program to run. Once entered, this is retained within the program, making this form of copy protection livable, to say the least.

The main screen displays a top row of menu choices, including the standard FILE and EDIT, along with more specific PACKET, MODES, and CHANNELS. An integral text editor is available for editing received or transmitted text. The large window at the top is the receive window, with a smaller transmit window at the bottom. A CONNECTS window shows the current number of stations connected to, polling the TNC after each ***connected and ***disconnected message to determine the conect status of each channel.

As you can see, this is a powerful program that fills the needs of many who have been looking for the best program to run that multimode controller. It should be mentioned, though, that this is a *packet* program. Although your controller may operate on other modes, PacketPeT is strictly packet radio terminal software. You will have to use another program to run your controller on straight RTTY, CW, or other supported mode.

This said, I think anyone who is running a compatible computer with the hardware and software requirements outlined above would be happy with this package. If you want to "try before you buy," check out the end of this column for details on how to order disk #5 of the RTTY Collection, which has PacketPeT Lite, the shareware version of PacketPet, on it. Otherwise, drop a note to Chuck Harrington Software, Inc., 1565 Brazilian Lane, Winter Park, Florida 32792-2309, and tell him you want a copy of PacketPeT, as described in this month's "RTTY Loop." I'm sure he will be happy to send you current pricing and availability information.

I received a letter from Bill Shimmin W7GBC ol Tacoma, Washington, which speaks well of you RTTY Loopers. Bill recalls that "sometime back, I wrote to you regarding a problem I was having in getting started in RTTY using a CP-1 and a C-64 computer. Your mention in the March 1994 issue of *73* brought a number of responses from your readers. Of special help were: Gail KC8V; Frank WA6RBQ; Bart W6OWP; Paul WA4FHY; and John KC7BS. Your readers really came through!

"I think my main problem was not recognizing that different manufacturer's software require different pin connections to the C-64. Your readers were most helpful in this regard. Also, your April article confirmed much of this information as it applies to the CP-1.

"One other comment: I originally had the impression that the CP-1 was more or less out-of-date in today's RTTY environment. Not so—as a number of your readers have pointed out."

Well, Bill, it's great hearing from you, and even more wonderful the way the readers of this column chipped in and lent a hand. To you: it's our pleasure; to our readers: my sincere thanks.

As I mentioned above, the "RTTY Loop" software collection continues to grow, with six disks available by the time this is published. Each collection is over 1.2 Mb of stuff: ham information, terminal programs, schematics, and the like. A list of the directories of each disk is available on the Radio SIG on Delphi, or may be yours for a self-addressed, stamped envelope mailed to me at the above address. Email users on CompuServe, America Online, or Internet can get the list as well by sending me a message on one of these services. The collections themselves can be yours for not too much trouble. Just send me sufficient media for each collection a (3.5" HD 1.44 Mb disk is fine, $2 in US funds for each disk to be filled, and a self-addressed, stamped return disk mailer) and I'll turn it around to you post haste.

Now, those Email addresses are: CompuServe—75036,2501; Delphi-MarcWA3AJR; America Online—MarcWA3AJR; Internet—MarcWA3AJR @aol.com.

Next month, I have a batch of letters to answer. That means that the IN box will be empty. Why not send in a comment or question of your own, for a future slot in "RTTY Loop"?

CARR'S CORNER

Number 13 on your Feedback card

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Out of this World DX

Several issues ago I covered the 10 May 1994 solar eclipse, and recommended some radio observation techniques for "looking" at the eclipse via ham radio. An eclipse of the sun occurs when the moon passes between the earth and the sun, temporarily blotting out the sun, or at least a part of it. The degree of blotting out of the sun is a function of where one observes relative to the "ground track" of the eclipse shadow. This year's eclipse was an "annular" eclipse, meaning that the moon didn't fully blot out the solar disk, even in totality, but rather left a ring of light (hence the "annular" name).

People observing solar eclipses tend to use lower frequencies because the main effects are seen at those frequencies that are most affected by D-layer ionization. Anyone who listens to 75/80 meters knows that D-layer absorption during daylight hours is quite high, but at night, as the ionization levels of the D-layer decline, the absorption gradually disappears and skip communications (via the ionosphere) takes place. Indeed, DXCC has been awarded for all 75/80 meter band contacts. And, if you're a denizen of the pre-dawn like me, a distressing habit I picked up delivering a morning newspaper 35 years ago, you'll know that all kinds of wonderful long-distance stuff is heard in the hours 'tween midnight and sunrise.

When a solar eclipse occurs, ionization levels in the D-layer begin to melt away, just like at night, and the lower frequencies become slightly more active. In an annular eclipse the return to night conditions seems a tad less than in a total eclipse, probably due to the light that peeks around the moon during such an event.

Several people wrote to me and shared results of their 10 May observations, but Gordon Hayward VE3EOS sent along a computer graph of his data (see Figure 1). Gordon selected 5 MHz WWV in Fort Collins, CO, for his observations. His receiver was a tube-type World War II era ATR5, which he left on for several hours of stabilizing warm-up. Gordon calibrated the S-meter of the receiver for S-9 being equal to a 50 µV signal level. Data was collected using a computer data logger that recorded the S-meter readings every 10 seconds for several hours (7,711 readings).

The graph in Figure 1 shows the results of Gordon Hayward's observations. For comparison Gordon left the instrument recording from sunset the evening before until after the eclipse, showing clearly the expected behavior for the 5 MHz signal in the presence of changing D-layer ionization levels. The signal strength of WWV (5 MHz) rises from -38 dB (relative to S-9 or 50 µV), to something higher than S-9 (which is the 0 dB level). The signal levels remain high throughout the day, and then drift back to daytime levels within a couple of hours post-sunrise.

The eclipse was recorded at 1700 UTC, with a 4-5 dB rise. Again, it probably would have been more if the eclipse had been total, or if it had lasted longer; to quote Gordon: "The ions aloft likely take some time to recombine when the light levels drop." Gordon's recording site was Kitchener, Ontario. The peak indication occurred at a time when the eclipse ground track was about midway between Kitchener and Fort Collins (site of WWV).

Good work, Gordon, and thanks for sharing the results with the rest of us.

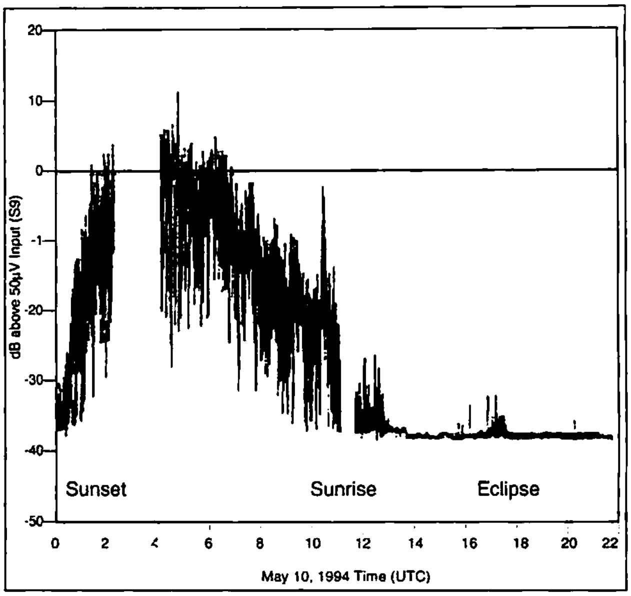

Figure 1. The May 1994 solar eclipse WWV sounding.

DXing Jupiter (One-Way)

The planet Jupiter, the largest in our solar system, is well-known as a radio source. Unlike other astronomical radio sources, which are microwave, the Jovian radio signals are found between 5 and 40 MHz, with a distinct peak in activity between 18 and 24 MHz . . . frequencies that encompass three amateur radio bands.

The sounds made by Jupiter are a rising and falling "swooshing" sound . . . my wife likened them to waves . . . in the white noise. I suspect that most 13, 15 and 17 meter band operators have heard these signals and didn't know what they were, or simply ignored them altogether. According to the literature, a person looking for Jovian radio signals has about a one in six chance of hearing them.

In the third week of July, a comet that has broken up is scheduled to impact Jupiter (which should be past when you read this column), and the impact will profoundly affect the Jovian atmosphere for weeks to come. Ouite a spectacular display of radio activity is expected, and some sources expect it to continue for weeks. Perhaps what this means is that the chances of hearing Jovian noise rise from one in six to something a little more probable.

So what do you need to listen in on the Big Fella of the solar system? Not much, it turns out. It would be handy to have a general coverage receiver that does a competent job over the 18 to 24 MHz range. Even a ham-band-only receiver should result in observations much of the time. It would also be handy if the bandwidth of the receiver was relatively wide—say—what one might see on a receiver with "Wide AM" capability. Prime listening hours are 2200 to sunrise, local time. The idea is to get as many interfering signals off the air as possible, and that includes skip signals. Indeed, on the non-amateur portions of the spectrum, where there is little possibility of local stations, the 2200 starting time could be earlier on any day where the maximum usable frequency (MUF) drops significantly below 18 MHz earlier than 2200 hours.

The signals from Jupiter should be audible any time the planet is above the horizon, and "transmitting." Astronomical books and publications can usually give you that data. If you don't know how to access it, then get in touch with a local astronomy club or stargazing buff.

Jupiter can rise pretty high in the sky, and that can affect your choice of antenna. A 15 meter beam aimed in a southerly direction (for North American readers) will probably do the trick, provided that its elevation main lobe isn't too horizon-restricted. In any event, a simple 15 meter dipole will also do the trick. Some observers use three dipoles on the same feedline, cut for 13, 15 and 17 meter ham bands, with overlapping coverage for the frequencies between them. The dipole should be run east to west, so that it looks north-south.

"An eclipse of the sun occurs when the moon passes between the earth and the sun, temporarily blotting out the sun, or at least a part of it."

A lot of Jovian signal hunters use a variant of the directional discontinuous ring radiator (DDRR) antenna. That's the one in *The ARRL Antenna Book* that looks a bit like a horizontal hula hoop, with a section cut out along the rim, laid over (and about a foot above) a chicken wire ground plane or "counterpoise" ground. Although the signals should be strong (Jovian signals are second only to solar signals in strength) when the DDRR antenna is ground-mounted, some Jovian hunters like to angle it up on a stand so that it faces the southern sky in the vicinity of where Jupiter rises.

Let me know if you capture any Jupiter signals. I'd be interested in your observations.

Antlers for Windows

A number of readers have obtained the Antlers antenna calculator software from me over the past two years. The Windows version is now available ($30). This new version makes the same calculations, but uses scroll bars to enter critical parameters (such as operating frequency). It also expands the loop antennas' function. A schematic of each antenna is viewed on the screen whenever a selection is made. If you are interested, contact me at P.O. Box 1099, Falls Church, VA 22041.

QRP

Low Power Operation

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Massillon OH 44646

My grandfather always told me fall is in the air when the wind blows across the wheat stubble. Since the wheat has been cut and the wind is whipping up, let the autumn homebrewing season begin! I can't think of a better way to celebrate the end of summer than smoking a resistor or two on the perfboard. Since the summertime QRN is finally starting to wind down, an 80 meter receiver would be a grand project to start the season.

The LCK-80

This project is a simple little superhet receiver based on the ever-popular NE602 mixer. The LCK-80 comes from the gang in the UK and is kitted up and sold by Kanga. Bill Kelsey (3521 Spring Lake Drive, Findlay OH 45840; telephone: 1-419-423-5643) is the US distributor for Kanga kits. The price of the LCK-80 (both the receiver and transmitter boards and parts) is $70 plus shipping.

Thanks in part to the newer generation of integrated chips, such as the NE602 mixer and the MC1350 IF amplifier, building a superhet receiver is not much more difficult than a direct conversion receiver. Perhaps the biggest stumbling block is the IF filter and the BFO crystal. The LCK-80 comes with a set of matched crystals for the IF filter and the crystal for the BFO. You can change the operating frequency of the LCK-80 by using a different IF frequency, but you'll need to order a different set of rocks if you do. The required information is included in the LCK-80 instructions.

Signal Flow of the LCK-80

There are two tuned filters signals must pass through before going to the NE602 mixer. The front end will tune only one section of the 80 meter band. After the desired signal passes through the tuned sections, the signal is mixed in the NE602. The local oscillator is also produced by the NE602 chip. The operating frequency of the local oscillator is 8 MHz. The local oscillator is tuned by a 40 pF variable capacitor. Operating frequency is set by the transformer and capacitors making up the tuned circuits. I found the operating frequency was too low, and ran out of adjustment on T3. So, I reduced the value of the capacitance in the circuit, allowing T3 to cover the proper frequency range. With the local oscillator running at 8 MHz, it's a bit touchy setting T3 for the proper frequency.

After the mixer the signal travels though four matched crystals. The crystals provide the selectivity of the receiver, which I find to be just about the way I like to hear my CW—not real tight.

After the crystal filter, the signal is amplified by a dual-gate FET. This is a different route than that normally taken. Most designs use the MC1350 IF amplifier. But, I've found this chip to be a bit touchy. It can *take off* on you just by looking at it sideways. The FET provides enough IF gain, while remaining stable.

A second NE602 mixer is used as a product detector. The BFO crystal can be netted by a board-mounted trimmer capacitor. You can't select between sidebands, unless you add a second crystal and a switch.

Audio from the product detector is routed to the usual LM386 audio power amplifier. This chip provides enough bang to drive a small PM speaker.

On the PC board there is a VFO buffer so you can route the VFO to the matching transmitter. Also, the three major sections of the receiver can be muted by removing the VCC line. All T/R functions are done on the matching transmitter board. I'll have a closer look at the transmitter down the road.

Assembly

With all components mounted on a single PC board, construction is fairly straightforward. Of course, the strange UK parts slow down the process a bit but there were no hitches in the assembly of the receiver. Although the Kanga kit comes with a trimmer pot for use as the audio gain control, put it in the junk box and use a panel-mounted pot. You'll also need a 20 to 50 pF variable capacitor for the local oscillator. I happen to have on hand a rather fancy dual reduction drive capacitor that I pressed into service. Dan's Small Parts also handles some vernier drive variable capacitors that will work quite well with this receiver. You'll also need a speaker and a box to install the PC board in. It's odd, but there are no mounting holes in the PC board. You can drill in some if you wish; there seems to be plenty of room. Or, you could solder the board directly to some copper mounting supports.

There were a bit more instructions and assembly information this time than I've seen in the Kanga kits I've assembled in the past. In fact, there's even a PC board parts overlay that actually makes sense. Also, something nice this time is having the voltages shown on a separate schematic of the receiver. I found these very helpful when troubleshooting the receiver the first time. The LCK-80 is not hard to assemble, but it's not for the neophyte builder, either.

Tune-Up

Tune-up is simple. It requires only a frequency counter and an RF source. First, you need to adjust the VFO frequency by tuning T3 for the proper frequency. As I mentioned earlier, I had some trouble with the combination of capacitance in the oscillator and had to do some playing around with some values before I got T3 to tune correctly. After you have the VFO set, inject a signal into the receiver; it might have to be fairly strong at first. An oscilloscope makes tuning up the front end easier than by listening to the signal on the speaker. Adjust T1 and T2 for maximum indication on the scope. Remove the signal source and connect the antenna to the receiver. Now you should be able to hear signals as you tune across the band. Since the receiver has no AGC, strong signals will cause the receiver to overload and distort the audio. You can add a brute force RF gain control by using a 500 ohm pot to ground on the antenna input.

With the receiver's PC board mounted in a case, it proved very stable considering that the oscillator is running at 8 MHz. The receiver can easily hear signals my Drake R8 can hear down in the noise. During times of busy band conditions, the filter of the LCK-80 does not provide the best selectivity, but it heads above any direct conversion receiver. The LCK-80 provides single signal receive.

When I get some extra time, I'll assemble the matching transmitter and marry the two together for a complete 80 meter CW transceiver. It should prove an interesting project. But, in the meantime, just listening to signals on a receiver you built with your own hands is a lot of fun. 73

Number 15 on your Feedback card

HAMS WITH CLASS

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Dayton Youth Forum

My opening remarks at the '94 Youth Forum at the Dayton Hamvention were most unconventional in format. Due to emergency back surgery, I was unable to be present at Hamvention this year. The terrific folks at DARA, and good friends like Bill Pasternak WA6ITF, Ron Moorefield W8ILC, Noel McKeown WB8QQC and Gary Matthews KB8GOL pulled off some extraordinary feats to make sure I could still "be there."

I was discharged from the hospital an hour earlier than we planned. While sitting in a friend's car right outside the hospital, I called the Hara Arena to inform them that I was on my way home and would have to miss the teleconference call we had arranged. In true ham tradition, they patched my cellular phone call through the PA system at the forum. It was an experience I'll never forget! I was actually able to welcome everyone to the forum in Dayton while sitting in a car in front of a New York City hospital. I'll have to be lowered in by a helicopter next year to top this one.

The very capable Noel McKeown stepped in to take my place as moderator. By all accounts he did a superb job with the very talented youngsters we had lined up. My thanks to the McKeown family for all their good efforts.

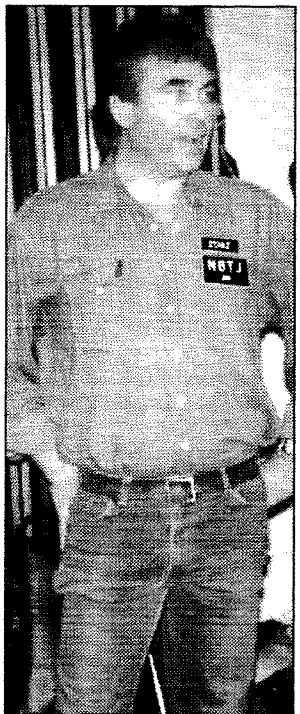

Photo B. N6TJ welcomes youngsters to join him when he goes to the Ascension Islands for DXing. (Photo by Jim Wilmerding N4MDC.)

This annual Youth Forum is nearest and dearest to my heart. Interviewing the youngsters from all across the country begins as early as June and July. It's a privilege for me to be able to showcase the bright and accomplished children who make such a vital contribution to the growth of amateur radio.

My dear friend Roy Neal K6DUE was first up to speak to the audience about SAREX (shuttle amateur radio experiment). He spoke with pride about how this program has put ham radio in the hands of the astronauts so they can speak with school kids all over the world. Roy is a tireless worker for AMSAT.

The first youngster at the podium was Chris Rismiller N8PEM, age 18. He spoke of his participation with a local radio club in an emergency drill with a mock airplane crash. Chris is also very active with the 4H club and has done many radio demos for the other kids to see. He stressed that ham radio is more fun when you get involved with other friends your own age.

Ray Glazer AA8MR, age 16, spoke about how he was introduced to ham radio and ATV by taking part in a 1,000 ft. balloon launch. He became involved with a local ATV group that organized the foxhunt after the launch.

Kevin Sil N9RPL is 15 and told about some funny experiences with foxhunting. He explained triangulation to the audience, and how foxhunters utilize this technique.

As I watched the forum on the videotape that had been sent to me, I was really proud of the children who got up to speak in front of a packed audience. I was especially delighted when the distaff members of the speaking group got up to the podium.

Laura Sobon KD4OZC is 10 years old and has an Extra Class license. She's been listening to her dad's radio since the age of six. Laura gave a very impressive presentation, including a video that showed the rescue efforts for a tornado emergency that she and her dad participated in with radio communications.

Cathy Gilliland KBØFDU is a 17-year-old who is working with Bill Pasternak and Dave Black on a video about amateur radio as seen through the eyes of a young person. She also gives radio presentations at a local middle school for Hobby and Career Day.

Jeremy Boerger N8PPY intrigued everyone with his description of the devastation at the tornado relief center he worked at with his dad. He wisely remarked that "catastrophic events happen, and amateur radio can always be a backup."

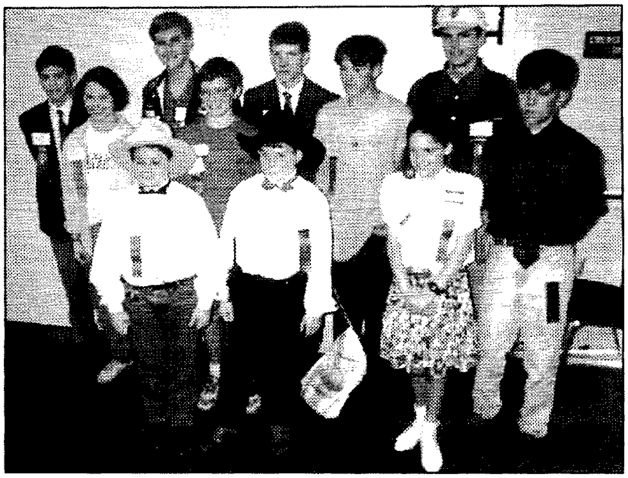

Photo A. Presenters at the '94 Dayton Youth Forum. (Photo by Jim Wilmerding N4MDC.)

Seth Wilson NØURQ is 14 years old and is vice president of the Boulder, Colorado (BARC), Jr. Amateur Radio Club. He describes himself as a "people person." Ham radio gives him a chance to meet many different people and to learn about all of their interests. Seth teaches other youngsters about radio. The club provides 10 different Elmers, so the children get exposed to various teaching styles and different areas of expertise.

At this point in the forum, Noel and Bill drew names to give out the books that were donated by the ARRL for prizes.

Casey and Cody Haley have done several youth forums with me as my guest speakers. They are always a big hit. Cody KB5WYJ is 11 years old and really enjoys all aspects of ham radio with the rest of his ham family. He told about a geography bee that he won in school thanks to the knowledge he had gotten from his radio contacts. His dad, Marty AB5GU, helps out with radio demos to the Boy Scout group the Haleys belong to.

Photo C. Chris Lougee with the winner of the 2meter rig, Darren Ellington KB4FBC. (Photo by Jim Wilmerding N4MDC.)

Casey AB5RG is nine years old and got his Extra ticket when he was only eight. Besides winning numerous awards, Casey has the distinction of being the youngest member of DXCC. He "loves to chase DX." He introduced Jim N6TJ/ZD8Z, who made a sked with him from the Ascension Islands. Casey says that radio is really great for a kid because it has helped him with his geography, science, and social studies. It has also gotten him the day off to speak at the forum in Dayton.

My good friend Gordon West WB6NOA was up next to invite everyone to join us both on "The CQ All Schools Net" next fall. (We meet on Tuesdays and Thursdays at 17:30 UTC on 28.303 MHz. If nothing is heard after 10 minutes, go to 21.303 MHz.)

Shawn Pattison KB4WXY, age 13, told the audience how he became interested in ham radio after seeing a demo in the second grade. He enjoys getting involved with the public service part of the hobby and recommends that youngsters get exposed to working with emergency communications.

Toby Metz KB7UIM, age 14, was fortunate enough to have his trip to Dayton sponsored by the local Boise, Idaho, Amateur Radio Club. This articulate young man gave a wonderful multimedia presentation highlighting his running of the Discovery Net. He was the net control for the SAREX STS-60 school contact. Over 25 other schools were linked up for the 10-minute contact with the astronauts. Over 19 questions from school kids were answered during the contact. The ever-popular "How do you go to the bathroom in space?" question went unanswered.

Danny Savino AA2GM is a 13-year-old Extra Class whose dad first interested him in amateur radio by showing him different QSL cards. Dan spoke about how to get young people interested in radio. He mentioned that foxhunts, moonbounce, space contacts, and working different modes are activities that provide action and excitement, which is what young people like. He proposed a youth net or a school club as good ideas to get large numbers of kids involved.

The grand finale of the Youth Forum came when Chris Lougee of ICOM drew a card out of a hat to present an ICOM 2 meter handie-talkie radio to a youngster under the age of 18. The winner was Darren Ellington KB4FHC.

It seemed to me from watching the videotape that a good time was had by all. My special thanks to all the children who turned out to be such excellent presenters, and to all the wonderful hams who pitched in to help with the forum.

Due to the large number of children who applied to participate in this year's forum we'll be starting to interview a lot earlier for Dayton '95 this year. So all you teachers and instructors and parents . . . keep your eyes and ears open for articulate, active young people who would like to be interviewed for next year's forum. Have them contact me at (718) 983-1416.

HOMING IN

Number 16 on your Feedback card

Radio Direction Finding

Joe Moell P.E. KØOV
PO Box 2508
Fullerton CA 92633

RACES RDF Goes High-Tech

You can learn a lot from a book or a lecture, but you can't master a skill without repeatedly performing it yourself. Otherwise, we would all be professional musicians after a few hours of just reading sheet music and listening to CDs. There's no exception to this rule when it comes to acquiring radio direction finding (RDF) expertise. Over the last 68 installments, "Homing In" has helped you select equipment and has described techniques for hidden transmitter searches (called fox-hunts or T-hunts). But the only way you will become an expert at it is to get some experience, by tracking down actual signals.

Three years ago, the Radio Amateur Civil Emergency Service (RACES) team for the County of Orange realized that rapid response RDF skills could be vital to the public agencies it serves. At the time, there were many regular T-hunts in Southern California, but most participants in them had years of experience. Existing hunts were usually too difficult to inspire confidence in beginners, so RACES members began holding their own monthly hunts. Liability concerns prevented them from calling these events official RACES drills or functions, but the group's leadership heavily promoted them.

RACES hunts are still held monthly on the 146.895 MHz W6KRW repeater, immediately following a Monday evening net. All listeners are invited to try their hand. The first hunt was extra-easy—just a mobile station "hidden" in plain sight in the parking lot of a popular coffee shop. Hider WA6LAB gave enough clues and encouragement that several hams were able to find him with only a mobile rig and a whip antenna, by gauging the strength of the signal. (This is commonly called "hot/cold" hunting.)

WA6OPS and I hid the second RACES T-hunt, trying increase the hunters' skill level. Our T was a dual-band hand-held modified for cross-band repeat operation, in a black box under a tree next to the curb of a dead-end street. Despite our continuing words of encouragement via the UHF link from our car a block away, hunters would drive up next to the tree, then drive away when they didn't see a ham in a car there. A few hunters complained that the hunt was "too difficult."

Now They're World Class

It's completely different today. These RACES hunters have kept at it, and their skills are as polished as the participants in the Southern California "expert" hunts. Nowadays, they love going on foot to "sniff" out concealed rigs at the end of the mobile portion of the hunt. For the most recent event, KE6AFR and KE6DVB stuffed their rig in a big bush under high voltage power lines. Their antenna was a quarter-wavelength bronze rod concealed inside a hollowed-out branch.

Members of the RACES RDF group have started two additional monthly events. One is a "progressive" hunt, where the first to find the T gets to immediately go out and put his own T on the air in a location of his choosing. The finder of the second T hides transmitter number three, and so on for the remainder of the evening. Another hunt features several T's, each beeping intermittently on the same simplex frequency from widely scattered locations. The first to find all of them wins.

T-hunting has boosted the spirit and camaraderie of this RACES team. Members gather informally at lunchtime several days a week to swap hunt stories, plan events, and draw new RDF equipment ideas on paper napkins. The newest gizmo on the RACES hunt scene (Photo A) is "T-Helper" by Robert Barris KD6IFZ, who loves both ham radio and digital technology.

According to Robert, "I started playing with microcomputers when I was in the fifth grade, learning on a Radio Shack TRS-80 Model 1. I wrote little programs in BASIC, played games and whatnot. From there it was the Apple II, then the IBM and now the Macintosh."

In 1986, Robert's computer acumen led him to a job at Quicksilver Software, where he and others write programs under contract for numerous computer brands. There he met Dave Steffen N6TCI and Byon Garrabrant KD6BCH. "They both got into ham radio and then joined RACES," he says. "I went on a couple of T-hunts with them, which got me interested in ham radio. I got my license about two years ago."

Most 2 meter mobile transmitter hunters in Southern California use rotating beams or quads to take directional readings. They use an RF attenuator to keep strong signals from pinning the receiver S-meter. Robert's T-Helper automates the process. It captures antenna mast azimuth and S-meter readings and feeds the data to his Macintosh PowerBook 180 laptop computer, which displays real-time polar plots of signal strength versus direction relative to the car's heading (Figure 1).

As the vehicle moves along and Robert manually rotates his RDF quad

Photo A. Robert Barris KD6IFZ goes on hidden transmitter hunts with Rachael Kent KE6GIO. His T-Helper interface board and automatic attenuator are in a cardboard box on the back seat with the battery.

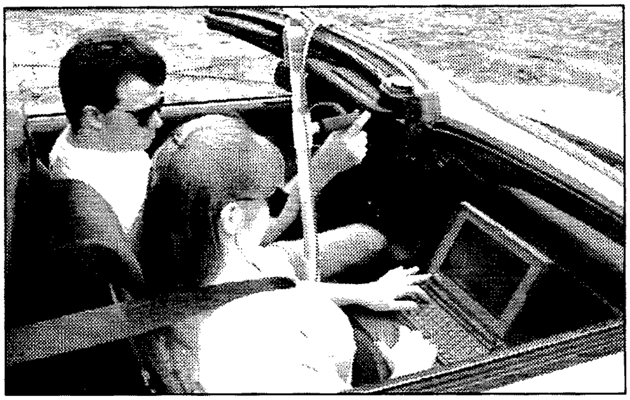

Photo B. Robert drives and turns the 2 meter quad while Rachael operates the computer. According to Robert, "She's an excellent navigator, very good at reading the maps."

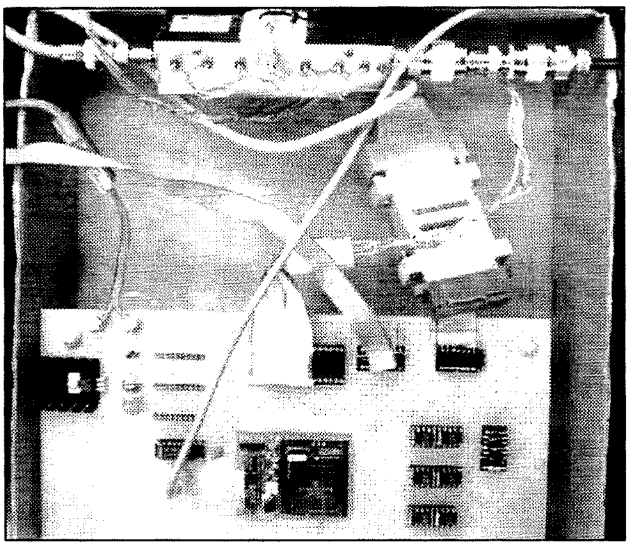

Photo C. KD6IFZ is still experimenting, so he has not boxed up the T-Helper as yet. The microcontroller module is in the center of a large piece of perf board, with analog S-meter voltage coming in to the left of the module. At the top of the photo is the surplus digitally-controlled RF attenuator from JFW Industries.

(Photo B), the display updates constantly. Old traces fade into the background, replaced by fresh information. KD6IFZ and his partner can easily tell which signal lobes are consistent and which ones come and go due to reflections from nearby hills and buildings.

T-Helper automates the job of setting the RF attenuator as the hidden T

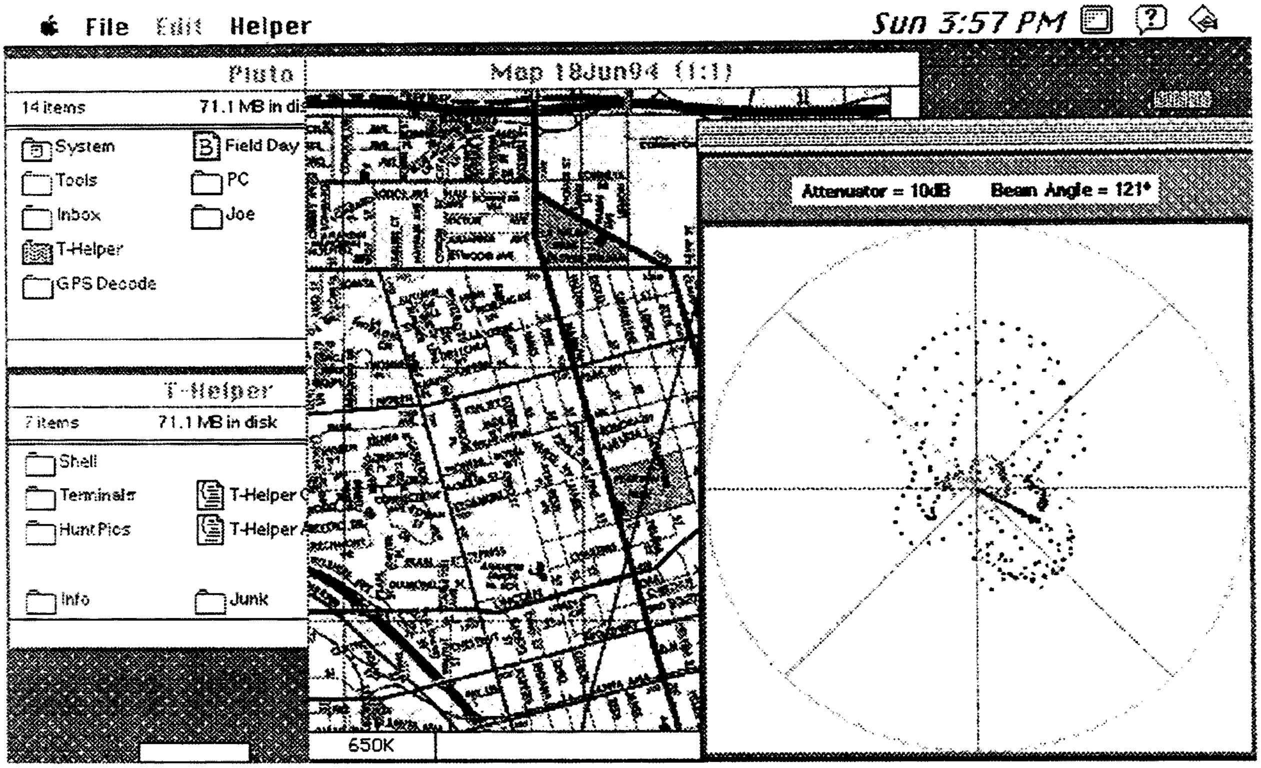

Figure 1. A typical display on KD6IFZ's computer during an actual T-hunt. Quad pointing direction (121 degrees relative to vehicle heading) is shown as a short dark bar in the polar display.

is approached. When signal level increases enough to drive the polar display off scale, Robert's program commands his attenuator to knock the signal level into the receiver down sufficiently to bring the display back into range. If terrain features suddenly block the signal or if the hider reduces transmitter power, the program reduces the RF attenuation.

A header bar on the 300 x 300 pixel polar display window tells the current antenna azimuth and attenuator setting. There is plenty of additional room on the PowerBook screen, so Robert added a map display. A separate window shows a portion of the county street map. The map is easily moved under the window to center it on the vehicle's location.

Affordable Data Acquisition

The T-Helper interface board (Photo C) is designed around a Motorola 68HC11 8-bit microprocessor. "It is a great chip for only about 20 bucks," KD6IFZ says. "I use a support module from CGN Company. The module is intended primarily for prototypers and people building onesy-twosy projects like me. It has a socket for the 68HC11, a crystal and a 5V-to-12V level shifter for RS232 interface. It also has all the necessary reset support circuitry, which is pretty tricky to get right on your own. That little $35 module is a computer in itself.

"The 68HC11 has analog-to-digital converters right on the chip. I'm using one of them to digitize the receiver S-meter reading. The meter circuit in my receiver puts out 0 to +5 volts, so it's a perfect match. There's no algorithm or smarts in the 68HC11 module, just a simple data acquisition process. The chip has a bootstrap mode. When you first turn it on, it watches its serial port. The host program in the PowerBook feeds it a little 180-byte routine at 9600 bits per second. The module loads it and runs it."

Antenna position data comes from a shaft rotation encoder attached to the bottom of the mast (Photo D). Robert explains, "The encoder has 2,000 counts of resolution, more than I can plot. What's more, determining shaft angle requires a rather hairy algorithm. The encoder does not give a nice 10-bit answer of which way the shaft is pointed. Instead, it has two outputs, called the A and B channels. Each generates a precisely timed square wave when the disk is turned. It's the same principle as the quadrature output encoders in a mouse."

Since the encoder output is relative, not absolute, the 68HC11 must read data continuously and keep track of the shaft position. "If you lost data, you would lose sync," says KD6IFZ. "But I've never had a problem that I could attribute to the encoder losing count."

Rather than using a PIN diode RF attenuator with analog input, which would have required a digital-to-analog converter module in the T-Helper to drive it, Robert looked for a digitally-controlled attenuator. Luckily, he found a suitable unit, made by JFW Industries, at a swap meet. "We weren't sure it was going to work on the 2 meter band," he says, "because it was designed for microwave frequencies, judging by the SMA type connectors on it." But he wrote a program to test it and determined that range and accuracy was good enough for this closed-loop application.

The "intelligence" for KD6IFZ's system is all in the host program, which runs in the PowerBook and communicates with the T-Helper board via a communications port. The operator can control many attributes from the keyboard, such as the rate that traces fade away. At startup, an initialization routine asks the operator to point the beam straight ahead and hit a key. The computer then automatically calibrates the shaft encoder output.

Reprogramming on the Run

Robert knows his program forward and backward, and he sometimes makes changes and recompiles it in the middle of a T-hunt. When taking photos of the setup, I asked if he could make the dots on the polar display bigger, so they would be easier for readers to see. After a couple of minutes of recoding and recompiling, the display had bigger dots. For night hunts, Robert prefers white dots on a dark background, which he can get with a

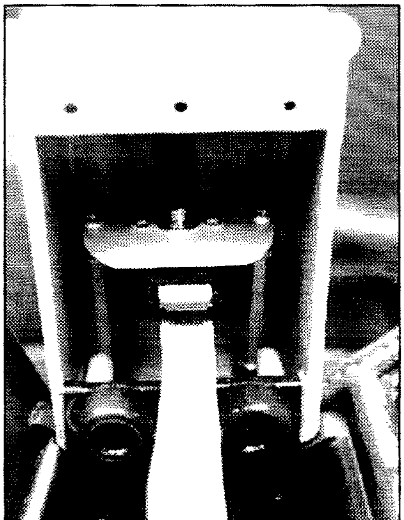

Photo D. A flexible hose connects the bottom of the rotating antenna mast to a shaft rotation encoder from US Digital Corporation. A permanent coupling is not necessary, because the computer calibrates the encoder readout before the start of the hunt.

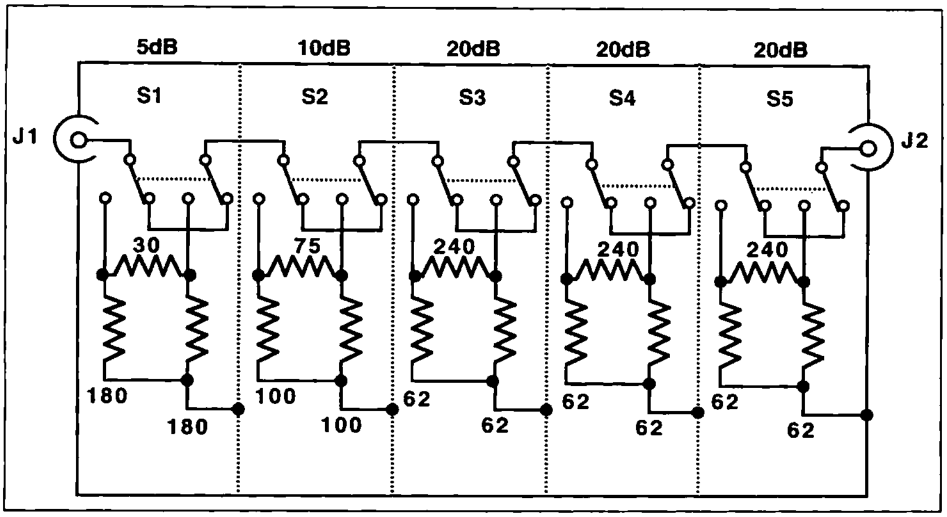

Figure 2. Corrected schematic for the resistive RF attenuator project in July's "Homing In."

few keystrokes.

When hunting, the host program loop sequence is simple: Read the antenna shaft angle, read the S-meter voltage, place the dot on the polar display, check il the S-meter is in range and reset the attenuator accordingly, then repeat. "The protocol between the host and the helper is very simple," says KD6IFZ. "The host sends out one character to assert a byte on the attenuator control lines. The character also serves as the go-ahead to send back a packet of azimuth/strength data from T-Helper to host.

"This happens about 30 times a second. There are six optoisolators connected to output pins on one of the parallel ports on the 68HC11. Every time the microcontroller receives a byte from the host, it asserts it on the six lines and the relays in the attenuator change to reflect it.

"The T-Helper board runs directly off a 12V gel-cell," Robert adds. "The computer has its own battery that lasts about two hours on a good day if you're not stressing the machine too much. We bring an inverter and the computer's battery charger along. When the battery gets low, we plug in the inverter and charge it up again."

Robert and Rachael won't brag, but the computerized system has served them well in the 10 or so hunts where they have tested it. "We haven't yet won any hunts where winner is determined by low mileage," he says. "But we won the first Monday night first-finder-wins RACES hunt that we took it out on. On that hunt, KD6BCH hid using a continuously rotating beam antenna for transmitting. The T-Helper worked like a charm.

"The other hunters had to contend with S-meter readings constantly varying 10 to 15 dB, which made accurate bearing-taking difficult for them. With the T-Helper, we could build up a pattern on the screen. As we swept the antenna slowly across the signal and let the peaks and valleys come and go, the pattern showed where the highest high was, which was the direction to the T. That was instrumental to our winning."

Always a Wish List

Like any good engineer, Robert is planning additions and improvements to his system. "I have to constantly remind myself that I didn't build it to win T-hunts, but to learn how to do some electronics," he says. "But I'd like to add a satellite navigation unit to know where I am, and a flux-gate compass to input the exact vehicle heading to the computer. Another feature I'm thinking of adding is a B-scope (rectangular X-Y) display, simply because it's sometimes easier to find the peak with it, compared to the polar display."

What about letting the computer calculate the best bearing direction from the displayed data? Robert thinks that some things are best left to the operator. "Judging by some of the patterns that we have gotten, I wouldn't trust the computer to make judgement calls on where the peak is," he says. "We prefer to keep moving and keep swinging the beam. If we see a strange blip, we can tell if it was or wasn't there before and decide whether to change direction or keep moving.

"I'm very much against the computer doing any interpretation. I like the program to have lots of ways to present the data, but ultimately it comes back to the human looking at it and making choices. That's also one of the reasons I'm against having a motor drive for the antenna rotation. Often we get into a situation where it's definitely in the front right quadrant, for example, and we want to just focus on that area for a while. We don't want to swing the full 360 degrees all the time."

Orange County RACES is full of technically competent hams, and KD6IFZ insists on thanking those that assisted him with the T-Helper project. "John Roberts WA6LAB was great for general consultation," he says. "He gave me some parts and got me started on the first circuit, to buffer the S-meter output from the radio. Mel Chester KB6MT loaned me his 6811 evaluation board to test my concept before I bought a chip and started building this thing. David Hess KD6LZA and Marty Mitchell N6ZAV gave lots of electronic assistance. Byon Garrabrant KD6BCH helped me a lot with the software."

And Finally . . .

Ooops . . . The *73* gremlins accidently shorted-out the DPDT switches in the resistive RF attenuator project in "Homing In" for July. A few extra connection dots crept into the circuit. Figure 2 is a corrected schematic.

Hardware and Data Resources Mentioned in this Article

CGN Corporation
1000 Chula Vista Terrace
Sunnyvale CA 94086
(408) 720-1814

JFW Industries, Inc.
5134 Commerce Square Drive
Indianapolis IN 46237
(317) 887-1340

US Digital Corporation
17401 Stoney Meadows Drive
Vancouver WA 98682
(206) 260-7451

PACKET & COMPUTERS

Digital Amateur Radio

Jeffrey Sloman N1EWO
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Getting Your Computer On The Air

This column usually discusses advanced topics, but even the most advanced among us started out with simple stuff. With that in mind I'd like to get more of you on the air so we can build up the pool of "packet experts."

Many of you with an interest in packet radio are already using your computer to communicate over phone lines using a modem. Sending and receiving data using amateur radio gear shares many of the concepts you already understand from the wirebound world of BBSs. If you are an experienced landline BBS user, you already own one critical component. If you are an average ham, you've got another—a 2m handheld. In fact, for many of you, the only thing that you'll need to buy is a TNC (Terminal Node Controller) which is the packet radio equivalent of your modem (but it's a lot smarter.)

What Do You Need?

The first thing you'll need to start out in packet is some sort of terminal. This can be a "dumb terminal"—an old-fashioned desktop unit often found at hamfests for anywhere from $0 to $20. Almost any dumb terminal will do, *but* not every terminal will work. Ideally, you want something that works as a "glass TTY" (a video version of a printing terminal) or VTxxx emulation, where xxx is 52, 100, 102, 220 (or higher). The VT terminal is an invention of DEC (Digital Equipment Corporation), and is just a little better than dumb. By sending a VT terminal certain command sequences you can get the display to do some interesting things like menus and reverse video, The higher the number after VT, the more modern and capable the terminal.

While a terminal will get you on the air, you'll find it frustrating after awhile. A terminal cannot run the sophisticated communications software that adds to the excitement after you get going. For this, you'll need a computer. Almost any computer can be used in a packet station. If you have a Commodore 64, 128, or Amiga, you'll find lots of other hams using this hardware and ready to offer help. If you use a Macintosh, you'll find plenty of software for your machine. The clear leader, though, in the amateur world will come as no surprise—The IBM-PC and its compatibles.

Just like the rest of the world, hams use the IBM-PC in greater numbers than any other machine. So if you don't own a machine, and you want to buy one for use in our shack—buy a PC. What sort of PC? Well, your best bet is to buy something that will properly run Microsoft Windows. Windows-based ham software is rapidly becoming the norm and offers wonderful ease of use. Basically, you'll want an 80486 with 8 Mb of RAM. Note that this is a very simplistic description, and you'll want to consult an expert (friend or dealer) for a more complete explanation.

Whichever machine you have, you'll be using one of its serial ports to connect the next box in the chain—the TNC. A TNC does two things for you. First, it has some intelligence built in. This allows it to interact with you through its simple user interface. For instance, to connect to another station, you type a command at the prompt:

cmd:c kb9bwe

This instructs the program in the TNC to do everything necessary to make a connection to KB9BWE. To do this it uses a special "protocol"—a set of rules—called AX.25. This is a "packet switched" protocol, and where packet radio gets its name.

Because of this built-in protocol and its "command interpreter"—the part that understands your commands—any sort of communications program will start you out.

The second major function of the TNC is to provide a modem that gets your data on the air. The word modem comes from MODulate DEModulate, and its job is to turn the outgoing digital signal into sound and the incoming sound back into digital information. It functions about the same way that your telephone modem does, but usually at a considerably slower pace of 1200 baud.

Let's take a moment to look at the idea of "baud." This technical term comes from the name of J.E. Baudot, a French engineer who did work on the telegraph. There is confusion about just what "baud" means—it is not the same as bps (bits per second). A baud is a transition from on to off, or logical false to logical true (0 or 1). When we say that a modem is capable of transmitting data at 14,400 bps, we are not saying that it is a 14,400 *baud* modem. The carrier for a 14.4 kbps connection is actually 9600 baud. Thanks to some fancy slight of hand, it is possible to send more than one bit per baud—get that? The modem sends more than one bit of data each time it makes a transition from high to low.

Now, this doesn't mean that you *have* to send more than one bit per baud, and in fact, in the average TNC 1200 baud = 1200 bps. This is somewhat slow for file transfer, but does OK for reading bulletins and keyboard-to-keyboard connections. More hams are looking at higher speed connections, though, and 9600 baud modems in TNCs are more popular than ever.

Choosing a TNC

TNCs come in a range similar to terminal equipment. On the low end are the simple TNC2 (a standard TNC design from TAPR, the Tucson Amateur Packet Radio group, which was greatly responsible for making packet a practical reality). These units can be found at hamfests for less than $100, sometimes considerably less. They can be purchased new for $100 and up. Good units to look for include the AEA PK-88 (and the internal version the PCB-88) probably my first choice in the low end, the Kantronics KPC-4, a nice small unit that is easily powered by a battery for portable use, and the MFJ 1270 which is truly a budget box—not my first choice but it will work and has many happy owners.

It is *very important* to be sure that any TNC you buy at a hamfest is a TNC2 and not a TNC1. While the firmware (on a PROM in the box) can be upgraded on many of these units, it is not the best way to start out your packet carrier unless you have help. Any *new* TNC will be TNC2-compatible. Any of these inexpensive and simple units will get the job done for the beginning packeteer. Once we get past the entry level, though, things start to get very interesting.

Multimode Controllers

Many of you may have your sights set on HF operation and all those esoteric modes like AMTOR (AMateur Teletype Over Radio) and PACTOR (A combination of Packet and AMTOR), or even just plain old RTTY (Radio TeleTYpe). To do these things, you'll need a multimode controller. Multimode boxes come in a wide variety, and choosing one is not a simple matter. I'll give you this advice, though: If you care about HF, buy an AEA unit. AEA is undoubtedly the best in the HF arena with its eight-pole Chebychev filter in the front end. If you want to work digital HF, look for a multimode controller.

The Radio

A transceiver replaces the phone line in our packet connection, and a good radio system is very important to packet operation. The AX.25 protocol uses a traffic control scheme called CSMA/CD (Carrier Sense Multiple Access/Collision Detection). It works a lot like 2M repeater operation:

Carrier Sense—listen before you key up.

Multiple Access—more than one station uses the same frequency

Collision Detection—"hey, you guys doubled"

Because this scheme depends upon all stations on the LAN (Local Area Network) hearing each other (Carrier Sense), your radio must match your LAN. In some places, you just won't get away with less than 50W. This happens when outlying stations make themselves part of your LAN. In order for them to reach stations—usually PBBSs located far from them but close to you—they run high power. This means that even though you could make a good connection with 5W to the station you want to talk to, others on the frequency will not know you are transmitting and will interfere. It is usually possible to find a frequency which supports truly local operations, for those that which to (or must) use handhelds and other low powered radios.

Antenna Selection

I said earlier that you needed a good radio "system." This includes your antenna. If you are inside a LAN service area, you must use a good omnidirectional antenna. For the all-important Carrier Sense part of the AX.25 protocol to work properly, you must hear them and they must hear you. 'They" being *everyone* using the frequency, *not* just the station to whom you wish to connect. The fact is, a good antenna can make a dramatic difference in a packet station's performance. I have had a great deal of success with a handheld into a Ringo Ranger at 25 ft., and a great deal of frustration with the same rig into a half-wave mag mount when it was all I could manage. The Ringo is a good choice, or, if you can spend the money, the Fiberglas co-linear designs from Diamond and Comet are simply great. Whichever antenna you buy, follow the mounting and tuning instructions carefully to insure a good VSWR.

What About a Beam?

Directional antennas may seem an attractive alternative to the omni, but they present a problem: Unless you intend a point-to-point link, and your antenna has an amazingly small beam width, *you are going to interfere with other stations*. There is one exception to this: If you live on the fringe of a LAN, and no other LAN user lives behind you (relative to the service area) or nearby to the sides of you, you can point a relatively wide beam toward the LAN. This can and does work in this case, and I am sure that some of you will be able to take advantage of this advice.

Get Help from your Local Hams

The final piece of advice is to seek out a friend in your town, or join a packet radio organization. There is no shortage of help out there, hams love to help others get started in their favorite part of the radio hobby. I'd like to help hams get in touch with individuals or clubs who can help a ham start up with packet. If you are such a person, or belong to such a club, write me on the Internet: jsloman@bix.com and let me know what your up to—I'll let others know here.

ATV

Number 19 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Big Shanty ATV

The Big Shanty Repeater Group operates a wide-coverage ATV repeater on top of Sweat Mountain just north of Atlanta, Georgia. Thanks to the efforts of Ralph Fowler N4NEQ and others in the group, this repeater offers a variety of features such as NASA Select (during Space Shuttle missions), weather radar and a number of live camera views from the top of the mountain. To alleviate the problems associated with an increasingly crowded 70cm band, they elected to go with a crossband repeater with an input of 1255 MHz (FM-TV) and an output on 427.25 MHz (cable-ready channel 58). Although there are quite a few ATVers with transmit capability on 1255 MHz, a much larger audience exists who like to watch the fun with very modest receive equipment (some using cable-ready VCRs hooked directly to a small antenna).

To improve the success of these viewers, the group embarked on a couple of projects to help stir up interest in the repeater. The first project was a small but very effective (and inexpensive) antenna designed by Kip Turner W4KIP that was made out of hog fence material. It was dubbed the "Hawg Fence" antenna and is in use by a large number of the Big Shanty group (construction details for the Hawg Fence will be given in an upcoming column).

In order to overcome inherent feedline losses and to help improve reception with cable-ready VCRs or TVs, Will Payne N4YWK developed a mast-mounted preamplifier that he dubs the "Hawg Amp." The following are Will's construction details for what has to be one of most cost-effective mast-mounted preamps you'll likely encounter.

The Hawg Amp

The heart of the Hawg Amp system is a Ramsey Electronics PR-40 preamp kit. Although it performs a bit below the more expensive and delicate FET types, this bipolar preamp offers a very respectable 10 dB (13 dB typical) gain, along with a noise figure of 1.2 dB (90 deg. K). It has a 3 dB bandwidth of 24 MHz (we measured 40 MHz) and operates with a supply from 8 to 16 volts with a current drain of 7 mA. The preamp's transistor is a 2SC2498 NPN and is equivalent to an ECG10 or SK9139. The real secret of the Hawg Amp system's success is to place the Ramsey preamp up at the antenna to eliminate the feedline loss. To avoid running extra wires to send power to the preamp, the preamp was modified to allow it to draw DC power from the center conductor of the coax cable. To accomplish this you will need to build a DC power injector (see Figure 1). You can think of a DC power injector (located in your shack) as a simple duplexer for two bands (DC and RF)—it allows you to put DC power into the bottom end of your coax without interrupting the received signal path.

Theory of Operation

In the original Ramsey preamp (refer to the schematic that comes with the Ramsey kit), the input from the antenna is applied through capacitors and inductors to the base of Q1. These input components form a UHF tuned impedance match from the input to Q1. Q1 amplifies the signal. Capacitor C4 couples the amplified signal from Q1 to the output. Resistors R1 and R2 set the bias on Q1 to draw about 7 mA of collector current, which is its best operating point. Capacitor C5 keeps the DC supply clean.

The Hawg Amp modified design takes DC power from the coax. Since the coax center conductor has 12 volts DC on it, R1 is connected right to the center conductor. Capacitor C4 lets the amplified RF bypass R1 to the output coax without being attentuated. Capacitor C5 is no longer needed here and the "DC duplexing" is built right into the collector circuit of Q1. At the indoor end of the coax (inside of the DC power injector), C5 keeps the DC clean in the power injector. Choke L2 couples

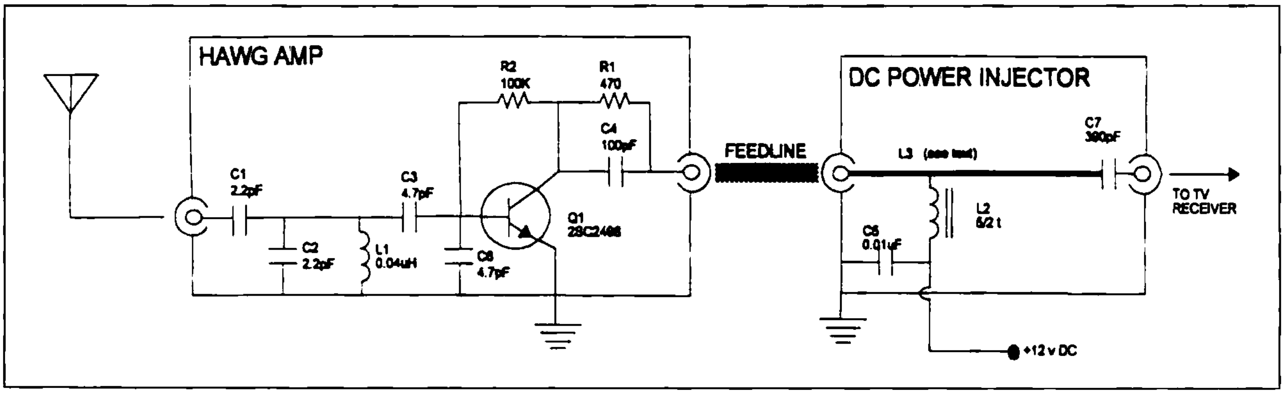

Figure 1. Schematic diagram of the modified Ramsey PR-40 preamp and the Hawg Amp DC power injector

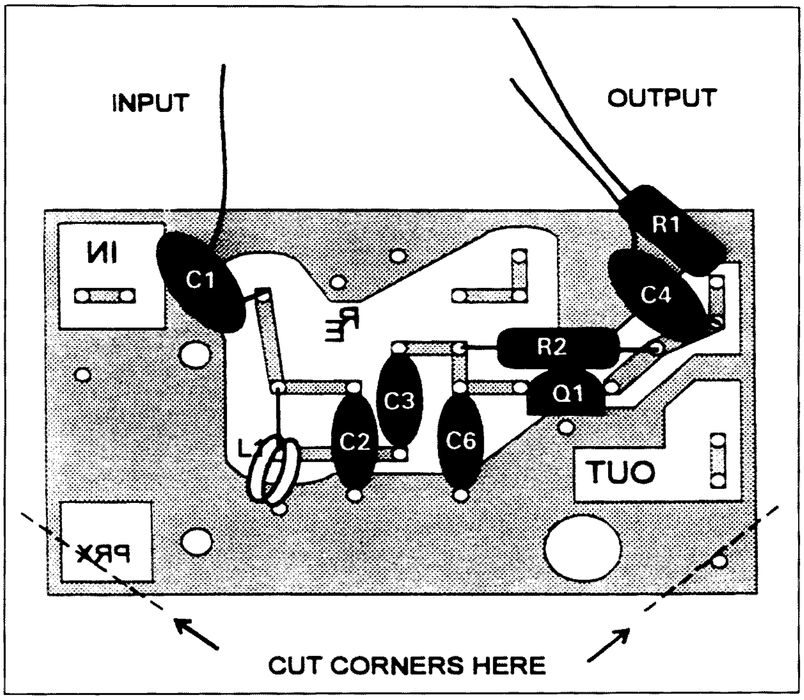

Figure 2. Parts placement of the modified preamp showing flying component leads.

the DC into the coax while blocking RF and capacitor C7 allows RF to pass through to your receiver while blocking the DC (many receivers don't like to see DC on their inputs).

Hawg Amp Construction

Build the Ramsey PR-40 preamp kit as shown in their instruction manual with the following exceptions: Install only one side of components R1, C1 and C4 to the circuit board. The other lead of each component will be left flying rather than using the PC board holes (refer to Figure 2 for details). These will be the leads for DC power, RF in and RF out. Do not install C5, it will be used for the power injector circuit.

Although you can use any case of your choosing for the preamp and the power injector, surplus CATV tap boxes, each having three F-type connectors were used to house the antenna-mounted preamp and the power injector. Desolder these tap boxes and remove their PC boards and at least one of the F-connectors. Save the F-connectors and one of the ferrite core baluns for use in the DC power injector. Remove the windings from the existing balun and rewind 1-1/2 turns of magnet wire through the holes of the ferrite core as shown in Figure 3. Then assemble your DC power injector as shown in Figure 4. Solder L3, a piece of heavy bare copper wire from the center conductor of the IN connector, straight towards the center conductor of the OUT connector. Cut L3 about 1/8" short of the OUT connector. Install C7 to bridge the gap from L3 to the OUT connector. L3 and C7 should run in a straight line about 1/8" from the metal wall to form a transmission line.

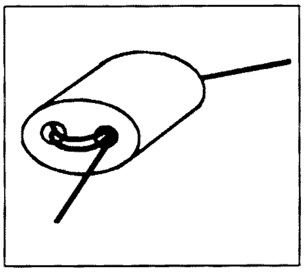

Figure 3. Balun winding details.

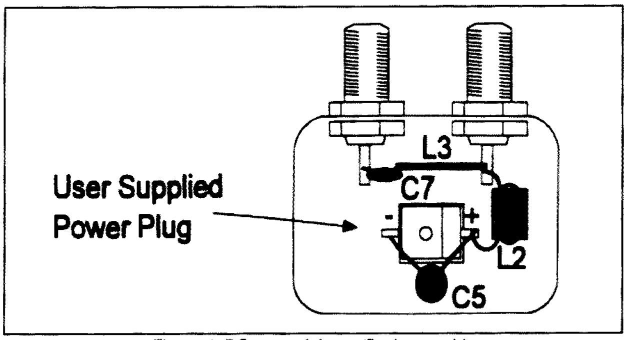

Figure 4. DC power injector final assembly.

Solder the ground lugs of the F-connectors to the bottom side of the Ramsey preamp and install the board and connectors into your case (you may have to cut the corners of the PC boards shown in Figure 2 if you are using a CATV tap box). Next, solder the flying leads of the preamp (C1's lead attaches to the Input connector; C4 and R1's leads attach to the Output connector).

Tune Up

Make sure you're getting the proper DC voltage from the DC power injector. If correct, hook it up to your preamp and attach your antenna to the preamp and check to make sure you're drawing around 4 to 10 mA of current. While observing a weak TV signal (P2 or P3 signal level to start with to find the best peak), adjust L1 by spreading or squeezing together its turns with a plastic tool until you observe the best picture. When adjusted, install your case's lid and get ready to install the preamp at the antenna. You can weatherproof your Hawg Amp by mounting it with the connectors down with a small cup or plastic container for a rain cover. RTV silicone rubber makes a good rainproof sealant if you leave a small opening at the bottom of the box. If everything is operating correctly, you should now have a noticeably improved received signal.

If you'd like a kit of hardware components and detailed construction information for the Hawg Amp (CATV tap boxes, magnet wire, 390 pF capacitor (C7) and necessary hardware—$10; everything including the Ramsey PR-40 preamp—$30), send a check or money order to Will Payne N4YWK at 2823 Oak Hills Dr., Dallas GA 30132.

ATV Net

If you are in the greater Atlanta region, feel free to check in with the Big Shanty Repeater Group. A weekly ATV net operates every Thursday evening around 9 p.m. EDT. ATV talk-in frequencies are 144.34 MHz simplex as well as the 146.655 (-600, optional 118.8 Hz PL) repeater.

Number 20 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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Loran Operation: Basic Principles

Last month I had a lot of information on 10 GHz operations to cover before the ARRL 10 GHz contest took place. For me, this is the premier microwave contest (I suppose just because I have fun participating in it). The 10 GHz contest is held on two separate weekends: the first in August; the second about four weeks later, in September. Operation is portioned to these two weekends to equalize the opportunity tor those participating from all parts of the country. I try to work both weekends, although there have been weekends in the past where no amount of power worked, because of bad days for excessive path loss. Thank goodness for another day's attempt—it was much better.

This month I'll continue discussing Loran system operation, and cover in detail how the Loran system functions and what benefits it can offer to us as amateurs. Loran, or, more properly, LORAN, stands for LOng RAnge Navigation. As I discussed last month, as amateurs we don't need the navigation aspect of Loran in our activities, with the exception of using it to compute precise grid square location information. Loran provides a useful calibration method for our home frequency counters. I briefly covered this application for frequency control, showing how to compare the onboard Loran receiver oscillator referenced to the high accuracy standards at the Loran transmitter site. I will get into this aspect of frequency accuracy later; for now, let's get into what Loran is and how it functions.

The best description of Loran I can find comes from a paper from the National Institute of Standards and Technology in Boulder, Colorado, by Michael A. Lombardi of the Time and Frequency Division (the document is a contribution of the United States Government and not subject to copyright.) I must thank the author for his simple explanation of system operation, and NIST for making this document available.

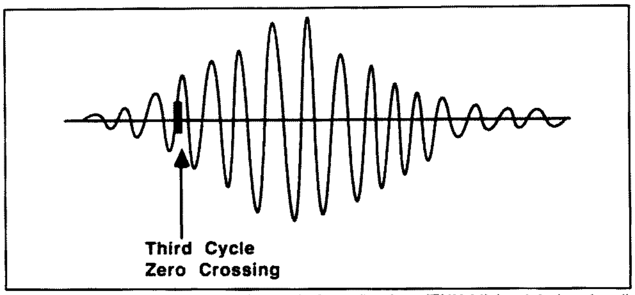

Figure 2. Loran-C pulse with third cycle identification. (TNX Michael A. Lombardi, NIST.)

Loran-C Operation

The Loran-C navigation system consists of nearly 20 synchronized "chains" or networks of stations. These chains provide coverage for most of the U.S. Canada, Europe, the North Atlantic, the islands of Central and West Pacific, the Philippines and Japan. Each chain has a master station and two to four slave stations; M designates master, and W, X, Y and Z designate slave stations. The master station transmits groups of pulses that are received by the slave stations, then they transmit similar groups of pulses.

All Loran-C stations (transmitters) broadcast on the same carrier frequency, 100 kHz. Because of this the receiver has to distinguish between signals from a number of different stations. Each chain is identified by a unique Group Repetition Rate, GRI. The length of the GRI is fixed and each chain is named according to its GRI (divided by 10). For example, the 7980 chain has a GRI of 79,800 microseconds. This means that every 79,800 microseconds (approximately 12 times a second) each station in the chain transmits a group of pulses.

The GRI must be long enough for each station in the chain to transmit its pulses and to accommodate for spacing between the pulses. The master station transmits eight pulses separated by a 1,000 microsecond delay. Then, 2,000 microseconds after the eighth pulse, a ninth pulse is sent. The ninth pulse is used to identify the master station. Next, 1,000 microseconds later, the slave stations send their pulses in turn. Each slave transmits eight pulses, separated by a 1,000 microsecond delay. For navigation operation, reception from the master and two slave transmitters is required.

The signal from each Loran-C transmitter radiates in all directions. Part of the signal travels parallel to the earth; it's called the ground wave. Part of the signal is radiated upward and is reflected off the ionosphere; this part is called the skywave. Receiving the skywave is less desirable than receiving the ground wave, because the skywave "moves" around and produces a less stable frequency (at the receiver). This movement is caused by the motion of the ionosphere and is due to the rise and fall of the sun. If you use the skywave for frequency calibrations, accuracy may be less than 1 x 10 to the tenth per day or less (optimum conditions). You will receive the skywave only if the ground-wave signal has traveled a long distance and is too weak and noisy for the receiver to track. If a receiver is within 1,500 miles of a Loran transmitter you should be able to receive the ground wave. (If you have a receiver that can tune to 100 kHz, the Loran sounds just like machine-gun-like chatter, which is it's pulse string and slave transmitters.

The Loran-C receiver is specially constructed to look for this pulse format and it can distinguish between the skywave and ground-wave signals. It does so by tracking the third cycle of a transmitters pulse. The third cycle arrives early in the pulse train, making it easy to discriminate and arrive at predictions based on this third cycle. In other

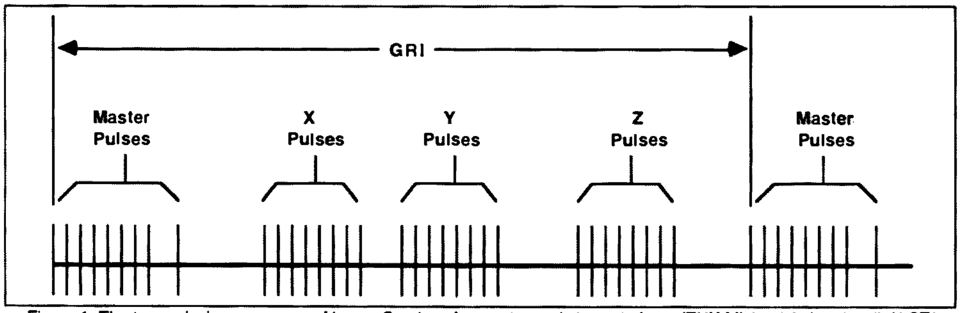

Figure 1. The transmission sequence of Loran-C pulses for master and slave stations. (TNX Michael A. Lombardi, NIST.)

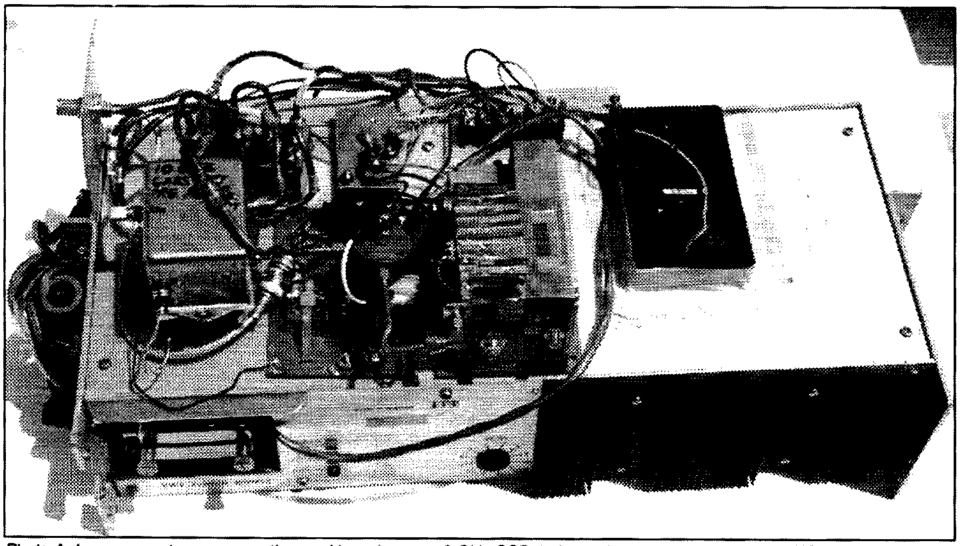

Photo A. In response to many questions asking what my 10 GHz SSB rig looks like, here it is: a 10 watt TWT. The large bottom unit is the power supply for the TWT. The top unit consists of two preamps, a brick oscillator-mixer, and four coaxial relays.

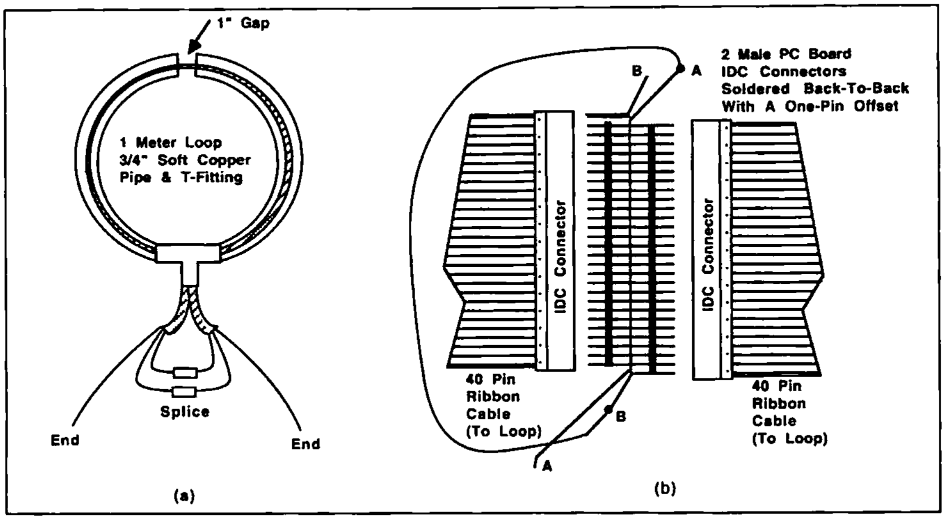

Figure 3. Construction ideas for a shielded loop antenna for VLF operation: (a) requires 40 splices, (b) requires simpler IDC connector with 2 male chassis IDCs soldered back-to-back, 1-pin offset.

words, if the pulse is of sufficient quality we can be fairly certain that it is ground-wave. Secondly, the third cycle has more amplitude than the first and second cycle in the pulse, making the distinction between signals identifiable. See Figure 1, Loran pulse sequence, and Figure 2, a single pulse with third cycle identified.

I would like to inject some personal evaluations here. Detecting the third cycle and tracking between station and differentiations between master and slave stations sounds quite intimidating. However these functions are accomplished by the onboard computer processor operation that is internal to each Loran receiver. The operator only has to connect the adapter and an IBM-type computer to interface with the receiver. The receiver and its internal circuitry takes care of all the other housekeeping and reports back to the operator its wellness or status value. This status value is printed in program step #75, which is included in the August 1994 "Above and Beyond" column.

This step prints position data and the "ST" or status information from the receiver. I discused this as a certainty factor, when in actuality it is called "ST" or status value, which is a hex number. The first number combined with the second number provides a status when compared to the chart shown in Table 1. Possible messages are: "88," meaning estimated position, advise possible ambiguous position; or "11," meaning verified position, data valid.

Suggestions for an Antenna

I had hoped to complete construction of a active antenna or test a loop type antenna for use with the receiver we have available. Lots of ideas have surfaced but I haven't had time to put them to the test. Kirk Bailey in Corvalis, Oregon, offered a suggestion on a loop antenna. He has constructed a copper-shielded loop that uses 40 loop turns. His approach for construction is a novel one in that a 40-conductor ribbon cable is inserted through the copper tube sections. At the bottom center copper "T," both ends are brought out and connected to standard IDC connectors. The male and female connectors are connected together one row of pins offset from each other. This effectively ties almost all pins in series, making the greatest 40-conductor cable to be inserted into a copper loop.

The loop is about 1 meter in diameter and, as in all loops, the top of the copper tube is open at the top, with a gap of about 1" being sufficient. If this were closed it would represent a shorted turn and the antenna would not function at all. Trying to wind a similar loop in other terms can be quite difficult—after a number of turns are made they seem to bulk up and it becomes very hard to wind more turns inside the copper tube. Other methods are quite possible, including placing a section of 40- to 50-lead cable and soldering together all the ends, keeping track of the start and finish and not having any shorted turns which would be defeating, to say the least. The IDC connector method is a little bulky but fast and sure-fire and puts to use inexpensive cables that might be junked. See Figure 3 for the IDC loop antenna construction method.

Don't forget that the horizontal loop is directional and not useful for navigation. However, it can be useful for tracking a single station for frequency calibration purposes. Another antenna type being tested is a common loopstick placed in a vertical position, thus making the ferrite loopstick "omnidirectional." A similar horizontal loopstick would exhibit directional capabilities. Most AM-FM portable radios use this type of antenna (horizontal), and show directional response. The loop antenna is similar in operation to a loopstick or ferrite rod antenna except that when the loop is horizontal it becomes omnidirectional.

Table 1. Status Values

First Digit	Second Digit
8 = estimated position initialization	8 = advise, possible ambiguous posn.
4 = coarse calculated acquisition position	4 = self-test comp., revert to zero
2 = calculated position (all station position)	2 = hardware /software error
1 = verified position	1 = data valid

I plan to construct a loop and a ferrite antenna for both my 60 kHz WWVB and 100 kHz Loran receivers. Test evaluation will be reported as progress is made. My TRACOR model 599J VLF receiver is what I use to receive WWVB transmissions on 60 kHz. The TRACOR 599J receiver can tune to 99.9 kHz, but it is prevented by design from receiving any transmissions on 100 kHz so it isn't compatible with pulse transmissions (Loran). Both the TRACOR and the Loran receiver boards are being used in conjunction with each other to verify how accurate my frequency standard is. Normal comparisons with the TRACOR receiver show accuracies to millihertz at 5 MHz. If I take a little more calibration time and fuss, the system is capable of much better accuracy.

The standard oscillator that I use for my master reference is Frequency Electronics Inc.'s Model FE-10A 5 MHz master standard. The FE-10 was acquired in surplus as "DEFECTIVE, OFF FREQUENCY," according to the repair depot's tag. Kerry N6IZW and I each obtained identical units, "defective standards," and recalibrated them in short order. We had hoped that they were repairable and took a gamble. The units seemed to function but were picked up in "as is" condition in surplus. In this case all worked out well but it took time to perform calibration due to settling in, (baking in) of the oscillators and their multiple ovens. I better stop here as this is getting into next month's topic: frequency counters and standards. I can't give away all the secrets for next month's column now, but it will cover several frequency counters and the main internal crystal oscillator standards that are used as the counters' reference.

Well, that's it from here on Loran and some antenna ideas yet to be tried. I am gathering materials to build the loop as I write this column and will report back on my progress. If you have any favorite circuits on antenna components for VLF applications drop me a line and I'll try to include them in a future column to share with our readers. For that matter, any items of interest will be included, space permitting, as this is your column and it's here to share ideas and promote interest in our VHF, UHF and microwave frequencies. VLF might be a little out of our operating frequency realm, except for calibration of test equipment. In this application its a must as far as I am concerned to know your frequency accurately.

Mailbox

Robert Krieger KAØQHV writes that he picked up from military surplus four transmitters, Model TCM-502BT, manufactured by Terra Comm/Loral, a San Diego Company; and two C-band omnidirectional antennas, PN #5064, from Microwave Specialty Co., also a San Diego Company. Robert states that he enjoys the column and the projects covered. The information is easy to understand and informative. He hopes that I can shed some light on these mystery boxes he has picked up. The transmitters are marked 4.5 to 5 GHz, but have no power specs or manuals of any sort. Robert would appreciate any information or opinions I may have concerning this equipment, especially conversion to ham band use. Contact Robert at 104 East 61st St., Davenport IA 52806.

While I am not familiar with the transmitters or antennas, some basic product information about what Terra Comm/Loral made might be helpful. They manufacture several microwave transmitters and receivers, mostly tor video transmission. I work for Pacific Telephone and we utilize several of their portable systems for certain special events. Power output from these transmitters was less than 1 watt, most running near 100 mW. Without further information specifically covering your devices, a picture or a sketch showing some of the units' details could possibly shed some further light on these units. I don't have much to go on but can offer some speculation on how to reverse-engineer the units.

What I suggest is that, seeing you have four transmitters, pick one candidate to open up and do some probing and non-destructive exploration. A good deal of information can be obtained from the from panel markings giving directions for circuit operation. Your letter hinted that this might be a simulator or beacon of some sort. Well, it this is the case, there should be a lack of input circuitry for adjustment and monitoring of either video or modu-

lation of some sort. The local oscillator might give a further clue. Is it fixed frequency or something more elaborate? One version of this company's local oscillator utilized a synthesizer that was capable of moving about 500 to 1000 MHz of coverage. The step or frequency jumps were large—something near 30 to 50 MHz per step, or channels as they called it.

Without getting confused in the unit's exact schematic circuitry, make a first-shot evaluation at a block diagram. Try to identify the local oscillator chain and make a rough guess at its frequency. Next, give a shot at the mixing scheme. If it has video transmission it has to handle baseband video or an IF type of signal, and that is usually at 70 MHz in most systems that use RF rather than video directly. Then I would give the transmit RF chain a shot. The thing here is to look for heat-sink devices. One possible trick here is that some of these systems that I have run across do not have power devices feeding the antenna. By that I mean a VHF power amplifier we couple out of the output stage directly to a coupling circuit to the antenna. In some of these early microwave transmitters, especially those with higher power outputs, there were not many devices that would work at 5 GHz eight or 10 years ago in those designs. What they did was develop power at a lower frequency, say half or one-third frequency, and use a diode (varactor) multiplier for the final output stage.

These are no more than an educated guess, but I hope they can give you a starting point to determine what you have. It is certainly interesting and, had I been given the opportunity to pick up the material, I would have done so, as long as I didn't have to mortgage the farm.

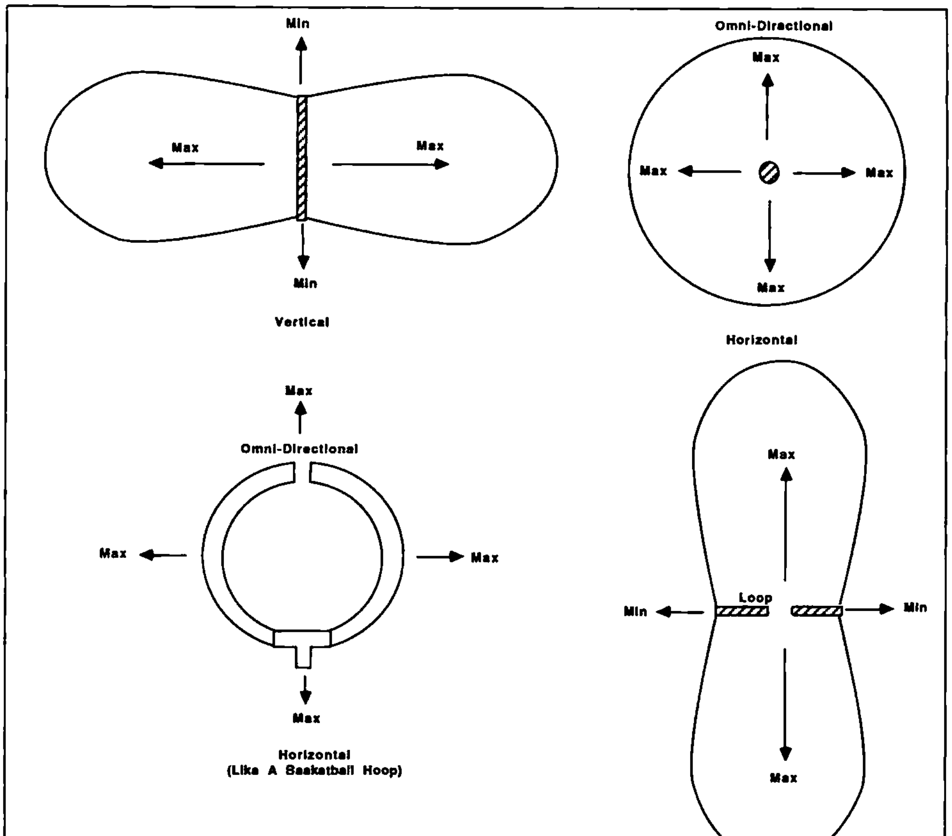

Figure 4. Comparison between loopstick and loop antenna radiation patterns for VLF receiver use.

Jim Kocsis WA9PYH picked up (at Dayton) a Micro Electronics Technology CL-2011 (Mfg. 1986) INMARSAT, whose approximate frequency of operation is 1600 MHz. Jim wants to use this for GOES reception at 1691 MHz. He tried the manufacturer, but they have no records. The unit has an external local oscillator in a block of aluminum, with four tuning stubs and three coupling adjustments tied to a braodband IF amplifier. Jim is currently building an antenna using a coffee-can feed and a five-foot dish for his 1691 system for GOES weather reception. If you have any information on this unit for Jim, contact him at 2217 Hidden Oaks Ct., South Bend IN 46628.

That's it for this month. I hope my treks through surplusland are interesting to you. Sometimes I find items in quantity sufficient to supply those interested in them before they become extinct. I try to pick up these items so they don't disappear before we amateurs can fully implement them. I have received many letters thanking me for making these items available to others. I hope that I will be able to continue to locate interesting amateur VHF UHF microwave home-brew items directly or indirectly. If the items are out there I want to tell you about them, wherever they might be, to help you hold the cost down in project construction. The main goal I have always had is amateur construction and enlightenment about the operation of circuits. As always, I will be glad to answer questions pertaining to this months topic and other microwave related subjects. Please send an SASE for a prompt response. 73 Chuck WB6IGP.

Number 21 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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The Ham At Play

We hams love to build things! At least, many of us do. I don't care how much DX you chase, there's just nothing like the thrill of making an electronic gadget of some kind and seeing it work. (Then again, there's nothing like the frustration of seeing it *not* work!) When we ponder building, we usually think in terms of a project from a magazine or a book. Or, perhaps, even a kit; kitbuilding seems to be making something of a comeback, as evidenced by the growing number of kit providers. Heathkit may be gone, but their spirit lives on in newer kit companies like Ramsey and Radiokit.

There's another kind of home-brewing, though, and this month we're going to explore it. I like to think of it as a kind of play. In this type of building, when you begin, you don't know exactly with what you're going to end up! It's less like science and more like art. Yup, you start with no schematic, no plans, no instructions, nothing. You just decide what you want to make and start making it! Can you really do that?

Have At It

Yes, you can. Honest. So, how do you start from scratch and come out with something useful? The first thing you need to decide is what it is you want to make. That's the easy part. The harder part is selecting a viable approach. There are lots of ways to make any given circuit. Depending on what it is you want it to do, there could be dozens of approaches which might work. But, before you even get that far, it pays to take a look at what you have handy.

Le Boxe de Junque

When you start from ground zero, you really can't go ordering parts, because you have no Idea what you need! So, take a look at your junk box, parts bins, old, scrappable boards and such, and try to formulate a circuit concept that fits into at least some of what you have. If you want to make a power-MOSFET RF amp, it would pay to have some MOSFETs hanging around. On the other hand, if you only need a half-watt output, perhaps those 2N2222As might do some good, and it might be worth rethinking the design to accommodate them, especially if the nearest MOSFET is an 800-number and two weeks away.

If you're primarily an RF builder, you probably ought to have some toroid cores and small, enameled wire for making those interstage transformers, filters and such. If you're into receivers, dual-gate MOSFETs and mixer diodes will be right up your alley. Of course, if VHF, UHF and above are your thing, you need the specialized kinds of parts those frequency ranges demand, such as surface-mount "chip" caps and monolithic microwave amplifier ICs. For the kinds of things I like to build, a good stock of 4000-series CMOS chips is essential. Some small transistors, an FET or two, and a nice selection of resistors and capacitors round out the goulash. Sure, I don't always have what I want, but at least I can get started most of the time.

Once you have some parts at arm's reach, you need something to put them on. For audio and low-frequency RF gadgets, those "protoboard" breadboarding systems are absolutely great. They have rows of holes into which you can push component leads, so you don't have to solder anything. Believe me, when you're designing from scratch, the last thing you want to do is solder, because you'll be changing your circuit arrangement around many times. Unfortunately, protoboards also have a great deal of capacitance and, therefore, capacitive coupling between the rows of holes. Up to a megahertz or two you can live with it, but beyond that it starts to get really noticeable.

Grunge

Along with all that coupling comes noise. As I mentioned, I often work with CMOS logic. Even though CMOS is inherently very low in power consumption, the switching transients do tend to show up on other signals when I use a protoboard. In a complicated circuit, it can lead to pulse jitter and all kinds of weird circuit interactions. So, is there an alternative?

There are several, but none is as easy to use as the protoboard. You can buy special PC boards which have rows of copper squares, all isolated from each other. You solder the parts to the squares and then solder wires from one to the other. But, as I mentioned, soldering is a real pain with this kind of work, so I try to avoid using this system. Still, I have had success with it in situations where the grunge level on a protoboard was just too high. You also can use good old perfboard. This stuff just has holes, no copper. You stick the parts' leads in the holes and solder from one lead to the other. I *hate* designing this way because making changes is very awkward. But, it's great for building prototypes of things you've already perfect-

ed on the protoboard. It's slow, but you can make reliable, small assemblies with this technique, and they're pretty indestructible.

And, let's not forget "dead-bug" construction, so named because of the resemblance of the upside-down parts to deceased insects with their legs in the air. Again, this involves solder, but it lets you make things that will operate at fairly high frenquencies without trouble, as long as you keep the leads short. And, if you don't wrap the leads around each other, it's not hard to heat 'em up and pull 'em apart to make changes. When developing RF circuits, I've used the dead-bug style for the higher-frequency stages, and laid the whole mess next to my protoboard so I could use it for the lower-frequency stuff. Naturally, there's no ground plane with this style of construction, and sometimes that can be a problem.

Another prototyping technique that's often overlooked is wire-wrapping. To wire-wrap, you attach parts to posts placed like pegs on a board. Then, you use a wire-wrapping gun in conjunction with some very fine, insulated wire and simply connect the dots; the gun makes a very tight wrap around the square pegs, automatically cutting through the insulation to make a good connection. This system has been very popular for digital circuitry because logic circuits often have a tremendous number of connections, and it's easy and fast to whip them together with the gun. Unfortunately, you wind up with a real rat's nest under the board, and tracing out a mistake or making a change can be extremely frustrating and difficult. For that reason, I hate wire-wrapping and avoid it for development work.

No matter what style of construction you use to test your circuit concepts, it's a good idea to use busses for your power and ground leads. It really cuts down on the noise problem. Also, don't forget some bypass capacitors. A big electrolytic in parallel with a few ceramics, placed right where the power enters the board, really can help. Also, if you still have noise problems, bypass the power going to each stage or IC with more capacitors. For logic circuits, a 0.1 µF bypass can do wonders in reducing switching transients' induction into the DC supply.

Where To Start?

It's crucial that you have test equipment and tools which are up to the job you're attempting. I've wasted many, many an hour trying to diddle some timing circuit or tuned stage into working, all to no avail because I didn't have the right meter or whatever. The most important tool you can have is an oscilloscope. Even though 'scopes don't give you the accuracy and precision of, say, a frequency counter or digital voltmeter, they can let you see things you just can't see any other way. Often, when DVM measurements look good but the thing just won't work, a glance at the 'scope instantly makes the problem clear. A good voltmeter is a must, though. Now and then the old, analog style of meter will do more for you than a DVM. Most of the time, however, the digital meter is far more useful. I still have an analog meter, but I rarely use it anymore. If you often make radio gear, a frequency counter is great. For tuned circuits, a dip meter is very useful, and I don't know why they've gone out of fashion; they tell you where any tuned circuit is resonating.

Good, clean DC power is something you just can't do without. From the type of project, you should have a sense of how much current you'll need. For all but power amplifiers, a couple of amps at 12 volts should be fine. Heck, for little CMOS gadgets, often 100 mA is more than you need. A regulated, variable power supply is great. But, if you don't have one, consider using a three-terminal regulator right on your project's board. They're cheap and simple, and they do a great job, often allowing you to use a surplus AC adapter for cheap DC.

OK, you've selected a construction method, and you have good tools and some parts. What now? Well, obviously you must know something about the basic configuration of the circuit you want to build. If it's a receiver, is it a superhet? A direct-conversion? A TRF? Or, if it's a logic-based gadget of some kind, what are its inputs and outputs supposed to do?

I find that level conversion and timing circuits are the ones which give the most trouble, so I usually do them first. For instance, if you're making a receiver that has an oscillator, or a transmitter, I suggest getting the oscillator to work first. Then, deal with the front end, driver amp or whatever's left. Once you know you have the required signals ready to go, it should be a simple matter to hook it all up with a mixer and an amplifier, or whatever else is required. I know, famous last words. It never works out that way, does it?

If it's a logic circuit, you probably have an input of some kind which must be conditioned before its levels will match the logic device's. With standard CMOS, the level isn't as critical as it is with LSTTL and other voltage-sensitive logic families. But, you may still need an amplifier stage or two, or perhaps some clipping diodes, to get things to match up. I find that logic gadgets usually must be designed from input to output, because each stage influences the next in ways I just can't simulate; I need the previous stage to work out the next one.

Next time, we'll take a look at some actual decisions you might make regarding choice of components and circuit configurations. Until then, keep playing, and 73 de KB1UM.

73 INTERNATIONAL

Number 22 on your Feedback card

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

As I am working on this column, the World Cup Soccer matches are being televised. I'm trying to figure out which is more distracting, the TV or the information provided by your Hambassadors. But, somehow, I will survive and finish this column.

Also this month, the first of the last two installments from David Cowhig, 73 Hambassador to Okinawa. We will certainly miss his personal observations from the beautiful island of Okinawa, but after a trip back to the U.S. for consultations in Washington, D.C., and some home leave, he will move to Taiwan and will continue his submissions from there. Have a great break, David, you deserve it! Note David's new address!

Also with David in mind, I was surprised to see one gentleman's name mentioned twice as I was working on the column, in two different contexts. Masayoshi Ebisawa JA1DM, IARU Liaison Officer and Director-General of JARL, sent a FAX concerning new frequencies in Japan, and then David Cowhig mentioned that he met Masa when David visited JARL Headquarters. Masa gave David one of his cards which is very special. It is one of Hokusai's 36 views of Mt. Fuji. It is being printed in the column for your enjoyment.

Next month, completion of David's and Rick Nui's articles, more information from Bill Meara in the Dominican Republic, Lorbie Gaston in the Philippines, and other info from around the world.

It's now time to get on with the great news provided by some of your Hambassadors. Without further ado, 73, Arnie N1BAC.

Roundup

Japan *FAX from The Japan Amateur Radio League, Inc. (JARL):* I am most pleased to announce that on May 20, 1994, the Japanese Ministry of Posts and Telecommunications has officially given permission for use of the following frequency: 3,747-3,754 kHz. It is to be noted therefore that the following segments can now be used within the 3.5 MHz band, by Japanese radio amateurs: 3,500-3,575 kHz, 3,747-3,754 kHz, and 3,791-3,805 kHz.

We ask all amateurs the world over, from now on, to please watch for JA's new band: 3,747-3,754 kHz. Masa Ebisawa JA1DM, IARU Liaison Officer. *[JARL, PO Box 377, Tokyo Central Post Office, 100-91, Japan; Tel: +81-3-5385-3106; FAX: +81-3-3943-8282.]*

Malaysia *Downloaded from packet, from 9M2SS via VK2AGE:*

LATEST UPDATE SEANET 94

22ND SEANET CONVENTION 11-13 NOVEMBER, 1994

VENUE: D'VILLAGE RESORT, MALACCA (MALAYSIA)

WELCOME TO SEANET '94 IN HISTORIC MALACCA (ALSO SPELT MELAKA). IT IS OUR PLEASURE TO INVITE AND WELCOME YOU TO SEANET '94 AS WELL AS TO FASCINATING MALAYSIA. WE HOPE YOUR PARTICIPATION IN SEANET '94 AND YOUR VISIT TO MALAYSIA DURING VISIT MALAYSIA YEAR 1994 WILL BE MOST MEMORABLE AND CHERISHED HIGHLIGHT OF THE YEAR FOR YOU.

CONVENTION REGISTRATION FEE FOR SEANET '94 IS RM160 PER PERSON. AND INCLUDES CITY TOUR AND MOST MEALS, EXCLUDING TRANSFER FROM AIRPORT/HOTEL/AIRPORT.

ACOMMODATION REGISTRATION:

OFFICIAL HOTEL: D' VILLAGE RESORT, AYER KEROH, 75450 MALACCA. ACCOMODATION: MOTEL CHALET RM100 STANDARD CHALET RM130 SUITE CHALET RM160 SINGLE/DOUBLE. ALL ROOMS ARE AIR CONDITIONED. RATES QUOTED ARE IN MALAYSIAN RINGGIT (RM) AND IS ON A PER NIGHT BASIS INCLUSIVE OF SERVICE CHARGE, GOVERNMENT TAX AND TWO BREAKFASTS. ALL PAYMENTS IN MALAYSIAN RINGGIT (RM) N.B. EXCHANGE RATE IN MAY '94 IS APPROXIMATELY US1 = RM 2.71.

MODE OF PAYMENT: MONEY ORDER/BANK DRAFT/BANKER'S DRAFT IN THE NAME OF "MARTS-SEANET"

CONVENTION PROGRAMME:

FRIDAY, NOV 11

SEANET '94 REGISTRATION 10AM-5 PM. OFFICIAL LAUNCH BY THE RIGHT HONORABLE CHIEF MINISTER OF MALACCA WITH A GRAND WELCOME DINNER SPONSORED BY THE MALACCA STATE GOVERNMENT. PARTICIPANTS WILL ALSO BE TREATED TO A CULTURAL SHOW.

SATURDAY, NOV 12

THE PROGRAMME WILL INCLUDE A CONDUCTED TOUR OF HISTORIC MALACCA, SHOPPING TRIPS FOR SPOUSES/CHILDREN OF PARTICIPANTS AND TECHNICAL SESSION FOR SEANET '94 PARTICIPANTS. A BANQUET IS SLATED FOR THE NIGHT WITH SING-ALONG AND LUCKY DRAW SESSION.

SUNDAY, NOV 13

A PLENARY SESSION HOSTED BY MARTS WILL BE HELD IN THE MORNING. THE VENUE FOR SEANET '95 WILL BE DECIDED AT THIS SESSION. THERE WILL BE A FAREWELL LUNCH BEFORE HOST BIDS 'SELAMAT JALAN' (FAREWELL) TO ALL PARTICIPANTS. DURING THE CONVENTION MARTS WILL OPERATE STATION WITH A CALLSIGN 9MØSEA.

ARRIVING MALACCA: THERE ARE NO SCHEDULED COMMERCIAL FLIGHTS INTO

THE CITY OF MALACCA. ARRIVALS INTO MALACCA VIA THE MALAYSIAN CAPITAL CITY OF KUALA LUMPUR (KL) IN THE NORTH AND SINGAPORE IN THE SOUTH ARE BY THE EXCELLENT AND SCENIC NORTH-SOUTH PLUS EXPRESSWAY. ROAD TRAVEL TIME FROM KL IS ABOUT 2 HOURS (200 KM) AND FROM SINGAPORE 4 HOURS (400 KM). A SUITABLE TRANSFER FROM KL AIRPORT/HOTEL WILL BE ARRANGED PROVIDED ADVANCED INFORMATION IS SUPPLIED. GROUP TRAVEL IS ENCOURAGED. COST OF TRANSFER IS ON PARTICIPANT'S ACCOUNT.
MALAYSIAN AIRLINE IS THE OFFICIAL CARRIER. SPECIAL FARES AVAILABLE FOR REGISTERED PARTICIPANTS BEFORE SEPTEMBER 15. ALL CORRESPONDENCE TO: SANGAT SINGH, 9M2SS, ORGANISING SECRETARY, SEANET '94 SECRETARIAT, 111 JLN. TERASEK LAPAN, BANGSAR BARU, 59100 KUALA LUMPUR (MALAYSIA). CONTACT NUMBERS: TELEPHONE: (603) 256 1571; FACSIMILE: (603) 253 7373.
YOU MAY ALSO CHECK INTO SEANET 14.320 MHZ +/- QRM AT 1200 UTC AND INQUIRE FROM THE NET CONTROLLER.

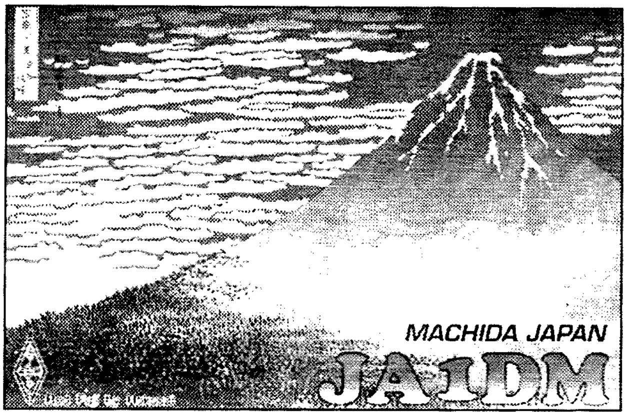


Photo A. QSL card of Masayoshi Ebisawa JA1DM, Director-General of the JARL.

Switzerland *Press release from International Telecommunication Union (ITU):* Study Group 14 of the ITU decided to adopt a new standard for future high-speed modems. This adoption will give a go-ahead signal to the industry to offer new products using high performance data transfer technology. The new standard will be called V.34 and will surpass the current technology used in data transfer via traditional telephone lines.

V.34 future modems will transfer data at speeds twice the current technology, thus the nickname *V.fast*. These new modems will have variable data transmission capacity ranging from 2,400 bit/second all the way up to 28,800 bits/second. The new modems will use a feature called "line probing" that will allow modems to identify the capacities and quality of the phone line and adjust themselves to allow, for each individual connection, for maximum throughput using the highest possible data transmission rate. In addition, the standard will support a half-duplex mode of operation for fax applications and will support automoding to existing V-series modems.

V.34 will not only foster worldwide connectivity due to its adaptive capacities, but will enlarge the market opportunities in areas which face poor telephone line quality.

At the same meeting, a standard—Recommendation V.18—was also approved, which will provide, for the first time, recognition of the communication needs of the deaf and hard-of-hearing. This Recommendation, with its capability to interwork with all existing devices, provides the platform on which a universal standard communication device can be built.

The following is from the ITU Newsletter: TELECOM is the "Olympics of telecommunications," held every four years by the ITU, an is the largest event of this type in the world.

TELECOM 95 will take place in Geneva from 3-11 October 1995 and will comprise an Exhibition and Book Fair, Strategies Summit, and Technology Summit.

The theme of the Technology Summit is "Convergence of technologies, services and applications." Papers are invited to focus on applying technology and creating applications in this cross-sectorial environment. *[ITU, Place des Nations, CH-1211 Geneve 20, Switzerland.]*

Taiwan *FAX from Chinese Taipei Amateur Radio League (CTARL):* We are very pleased to announce that on July 1, 1994, the Chinese Taipei Ministry of Posts and Telecommunications has officially given permission for the use of the following frequencies: 3,500.0-3,512.5 kHz & 3,550.0-3,562.5 kHz; 18.0680-18.0805 MHz & 18.1100-18.1225 MHz; 24.8900-24.9025 MHz & 24.9300-24.9425 MHz; 50.0000-50.0125 MHz & 50.1100-50.1225 MHz.

All amateur radio stations over the

world, from now on, please watch for these BVs new bands. Thanks for your attention. Best 73 de Bolon Lin, BV5AF, President of CTARL. *[CTARL HQ, PO Box 39, Changhua 500, Taiwan; Tel: +(886)-4-7388746; FAX: +(886)-4-7385441.]*

PEOPLE'S REPUBLIC OF CHINA

Rick Nui BZ1QL
Room 316 Building 25
Tsinghua University
Beijing 100084
People's Republic of China
Packet: BY1QH @ JA5TX.JPN.AS

Ham radio on Beijing TV: A 25-minute English language television program about amateur radio and the Tsinghua University Amateur Radio Club (TUARC) was aired on Beijing Television (BTV) February 20. This may have been the very first time in China that our hobby was introduced to the general public via a noted TV station. Four of the club members—Nick, Gray, John, and Sean—did a super job in the show while Rick was behind the scene as an assistant director. Thanks to Sam N3NFK for a videotape of reference.

BT2000BJ QSLs: At last, all the stacked BT2000BJ OSL cards were sent out in the first week in April from TUARC. Again, we deeply apologize for such an "unbearable" delay. By the way, the BY1QH *Callbook* QSL route still works perfect: PO Box 2654, Beijing, China.

Wanna have a "BY" license? Requested by quite some amateurs interested in obtaining a BY license during their stay in China, we've gotten the following paragraph abridged from *China Ham News* 15 Jan 1994. Hope it gets more propagated and makes some sense.

"The People's Republic of China Sports Commission issued an important formal file regarding Amateur Radio in China on December 29, 1993, establishing a brand-new set of regulations for foreign amateurs who would like to obtain tentative licenses to operate from BY . . . According to the Government document, 1) Prior to the establishment of Amateur Radio reciprocal agreements between China and other countries, a foreign amateur, if he wishes to operate from a BY station, should send to the Chinese Radio Sports Association (CRSA) a formal letter of application where a copy of both his home country license and his passport is enclosed, along with clear description about why and when he visits China, and on what modes, from which QTH and from which station he wants to operate. This application should be directed to CRSA, PO Box 6106, Beijing, three months prior to the trip, and is charged five US dollars or 20 IRCs for return postage and other relevant costs. A foreign ham is then permitted to operate from the place(s) or station(s) specified by the tentative license confirmed, signed and sent by CRSA. The callsign pattern is: (your home call)/(the BY station call), e.g. DJ7BU/BY1QH. This regulation also applies to those from Hong Kong, Macao and Taiwan."

Right now a home station, under whatever circumstances, is still *not* permitted for a foreign amateur in China. With a close connection with CRSA, TUARC offers to help you handle all the license affairs at no additional charge provided you send all the required items to the airmail address (Attn: Rick Nui) at the beginning of this article.

Ham made it! Congratulations to Rick BZ1QL on being elected among over 10,000 students as one of the "Top Ten Student Elites of Tsinghua University" because of his hard work and many achievements in the amateur radio area. Mr. Wu Shaozu, General Secretary of China's National Sports Commission as well as a wholehearted supporter for ham radio development, was present in the awarding ceremony.

OKINAWA

David Cowhig WA1LBP
AIT TAIPEI
Department of State
Washington D.C.

The JARL Museum and the offices of *CQ Ham Radio* and *Ham Journal* were the highlights of my June trip to Tokyo. Mamoru Fujimuro JA1FC manages the fine ham history collection at the JARL Museum (Tel: (03) 5395-3121) located just 100 meters from Sugamo train station. The JARL museum has a wonderful collection of early ham radio equipment. After ham radio opened up in Japan in 1950 near the end of the U.S. occupation, the equipment of the typical Japanese ham evolved from home-brew to Hallicrafters equipment produced in Japan under license and then to Trio and other Japanese brands by the late 1950s. Many Japanese hams still dream of owning Collins equipment which still enjoys a reputation for very high quality in Japan. Fujimoru-san told me that atop the grave of Uda, inventor of the Yagi-Uda directional antenna, somewhere in the Tokyo region, sits a Yagi-Uda antenna! Uda was the inventor, Yagi was his famous professor who helped promote the new type of directional antenna in the scientific world.

The JARL International Section would like to help hams from any country get a Japanese ham license for their stay in Japan. Write to the JARL International section, 14-2 Sugamo, 1-chrome, Toshima-ku, Tokyo 170, Japan. FAX: 81-3-3943-8282. International Section manager, Jay Oka, who holds both JA1TRC and KH2J invites you to use his E-mail address: rdg02524@niftyserve.or.jp .

Japanese ham magazine giants Masao Hamada JH1ISF (*Ham Journal*), Shigeki Hosono 7L1FPO (*CQ Ham Radio*), and amateur cartoonist-but-professional-ham editor Shinichi Ogushi "Oxy" JH6QDK, and COMPUSERVE 101113,1763 (*Transistor Technology*) taught me about the Japanese ham world over sushi and beer. *CQ Ham Radio* is a telephone-book size monthly ham magazine. *Ham Journal* aims at hams who want to master the latest communications technologies, and *Transistor Technology* chooses each month an area to explore in depth such as analog technology, computer interfacing, Z-80 microprocessor applications, and current trends in electronics. (All these Japanese language magazines are available overseas through Japan IPS, Iidabashi 3-11-6, Chiyoda-ku, Tokyo 102, Japan).

Several hours wandering through the Tokyo electronics district of Akihabara revealed that IBM-PC standard computers running Japanese language DOS are becoming very popular in Japan. Hardware prices are falling fast and so are hobby computing and home multimedia computer systems, heretofore much less popular in Japan that in the United States, is growing very rapidly. Japanese PC-DOS loads fonts for the kana syllabary and about 5000 kanji into memory to make possible Japanese language text processing. *[Article continued next month.—Arnie]*

NEVER SAY DIE

Continued from page 4

conference in New Orleans in 1989 Sherry and I were returning late one night from a riverboat jazz concert and happened to pass a grungy little bar. The door was open and out tinkled some Scott Joplin music. I stopped Sherry and said we had to go in and listen. A couple of Cokes and hours later I was talking with Scott Kirby about recording him. Scott was playing Joplin the way I had been hearing it in my mind. He was a 24-year-old graduate of OSU and was making his living playing ragtime on the New Orleans streets with an upright piano on wheels.

So Kirby came to New Hampshire a few weeks later. Sherry located a Steinway grand in a Peterborough church. Luckily I had a recording engineer on my staff, so we set up in the church and recorded my first Greener Pastures Records CD. This was GPR-001, and it's sold very well. Very well for an independently produced CD. The six major record companies had, at that time, 96% of all music sales, with the other 4% shared by around 15,000 independents. That's a lot of slices from a pretty small pie. Most record stores won't bother dealing with the indies, as they're called. Too much trouble. And radio stations play major label stuff almost exclusively, so the public doesn't even know about indie music.

Someone ought to do something about that.

Then, the next year I was asked to give a keynote talk at an indie music conference in New Orleans. The more I talked with the indies the more I felt I might be able to help. I started by setting up a credit bureau to help the indies find out which of the hundreds of music distributors were paying and which were screwing their customers. I did find a few that actually were paying. But the music business is about as crooked as they come. Indies essentially have to sell everything on consignment and trust. Distributors then try, though not very hard, to get the music into record stores. The stores are supposed to pay after they sell the music, but in practice most of 'em only pay when they have to re-order. The distributor holds onto most of this money, just in case he gets returns later and the record company has disappeared by then, which many do.

The next thing I knew I was setting up a distribution company (Creative Music Marketing) and a mail order division which specialized in indie music. By then I'd recorded a couple more CDs of Scott playing Joplin's music, and graduated from the church, where we had to record after midnight to avoid truck noises from the street, to a makeshift studio in my garage at the farm. Well, it was fairly quiet there, except for the ducks and geese commenting on Scott's playing.

We'd located a couple fabulous old pianos for Scott which Knud Keller KV4GG, an old friend, had refurbished. The garage was pretty good, but not perfect. I eyed the back end of our old barn across the road. There's room for a studio there. So one of my employees who was into carpentering got together with his brother and $75,000 later we had one of the nicest studios in the country. I hope you can see it some time, it's a beauty.

I'd discovered a Vermont bluegrass band which I liked, so we recorded them. And they'd been visiting Russia and met a Russian bluegrass group in Moscow. The tape was great, so when they decided to come to America for a tour I got them to come to my studio, where we recorded Kukuruza. They play Russian folk music in the American bluegrass style.

As we started making more CDs we discovered the obvious: The more you make, the lower the price. So we started making CDs for other indies to build up our volume. Before long we were cranking out 100,000 and more CDs a month, and had made them for over a thousand indies. That's how things like this get out of hand.

Since we had the mastering facilities and the publishing ability to turn out the liner notes, we were all set to do CDs for the indies at great prices. Plus we had the ability to provide them with a free ad in *CD Review*, thus helping make a couple hundred thousand music buyers aware of it, plus a free ad in *Music Retailing*, a publication of mine which reached every known record store in the country.

I don't know how much all this helped, but indie sales for some reason went in three years from 4% of the market to 12%, a gain of about $800 million in sales.

Cold Fusion

A couple years ago the governor called and asked if I'd be a member of an Economic Development Commission and try to help the state recover from the recession. Indeed, I found that New Hampshire had been hit the worst of all states, with our unemployment rate going from around 2% to over 7%, with banks closing by the dozens, property prices crashing, and so on. It was a mess.

As a member of the Commission I found that the meetings with 30 people were useless. Nothing could get done or even discussed, so I started writing reports on what I'd discovered as a result of subcommittee meetings and reading the recommended books. I found out what had gone wrong with New Hampshire and offered some inexpensive, practical proposals for getting out of the mess. I looked into our school system, taxes, crime, drugs, and so on. I found that we'd be able to cut our school costs in about half, yet enormously improve the education our kids were getting. I discovered a way we could get our state bureaucracies to happily cut themselves in half within three years. I thought up a way to cut the costs of our prisons by 90%, while providing unlimited prison space and actually re-educate and motivate the prisoners. Things like that.

No one cared.

I put the first year of my reports out in a book which I've been hawking: *We The People Declare War On Our Lousy Government*. It was $16 with shipping. I still have a few left, so you can have a copy of this 360-pager for $10 postpaid, while they last. You'll enjoy it.

As I looked into health care I found there were a whole bunch of ways our medical establishment was screwing up. Our health system is being driven by the federal government, and that is both increasing our costs enormously, and keeping us from benefitting from new developments. I could see where we could expect to be almost illness-free within a few years if only the medical establishment, controlled by the pharmaceutical industry, would allow the needed research. They were busy discovering chemicals to fight the results of illness, and refusing to let anyone go after the causes.

In 1989 I read about Pons and Fleischmann announcing they'd discovered a new source of energy. Cold fusion. Then came a deluge of ridicule and cold fusion disappeared. Oh, I read in the Rensselaer Polytechnic Institute newspaper that a team of students had checked it out and had generated excess heat, just as claimed by Pons and Fleischmann. Then the August 1993 issue of *Popular Science* had an article saying that many labs around the world had validated the phenomenon, but that our Department of Energy (DOE) had prohibited any American labs from researching it. Apparently most of the work was now being done in Japan. Just what we needed, to lose out on what could be the biggest new industry in a hundred years.

Then I was contacted by K5CB, who was funding ENECO, a company investing in cold fusion patent applications and rights. He wondered if I might be interested in starting a magazine. What a dumb question. Having helped cellular telephones become an industry, then personal computers and compact discs, of course I was interested.

In December I attended the Fourth International Cold Fusion Conference on Maui. Yes, I cheated and went a few days early so I could visit all six major islands and go diving and hamming on them. For my birthday in September I'd visited 11 Caribbean countries and dived most of them. Hammed 'em too.

The first issue of *"Cold Fusion"* came out in April. Yes, cold fusion is real. And yes, the American scientific establishment is still fighing and ridiculing it. So what's new? I don't think you can point to any major scientific break-through that hasn't been ridiculed and resisted by the establishment. And the media. As Max Planck (quantum mechanics) said, "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it."

So today we have Pons and Fleischmann over near Nice on the French Riviera in a $25 million lab built for them by Toyota. We have the Japanese investing tens to hundreds of millions in new hydrogen energy research, as they call cold fusion. And here we have a physics professor in Vernon, Texas generating excess heat in his home lab, while our universities are wasting billions on hot fusion.

The advertising support for the new magazine has been much less than hoped for, so we'll be changing to a newsletter format until the field gets out of the laboratory and starts to become an industry. The main thing is to provide communication to help researchers progress.

From everything I've seen we will be seeing the end of the fossil fuel age very soon. No more gas stations. No more power lines going across the country. No more acid rain and pollution from our cars. I'm getting on in years, but I hope I'll live to see it happen.

I started out in the roaring '20s, lived through the great depression of the '30s. Fought in the war of the '40s. It's been quite a life.

So now *73* is entering its 35th year and I'm entering my 73rd year. I've tried to make *73* the ham magazine you like best. I watch the reader cards every month to see how much you like what, and we're guided by that. I am worried about amateur radio surviving the '90s. With the FCC starting to take our most valuable future frequencies away and auction them off, I can see the handwriting. Sure, we could easily become so valuable to our country that we wouldn't have to worry, but I see almost zero interest from anyone to make changes. We're having a great party and don't want to worry. I watch my mail. I read every club newsletter I get. I keep hoping to see some interest in preserving our future. I see nothing. Don't worry! Have fun! The party is never going to end.

I hope I'm not a bore when I nag, trying to get you to go out and *do* things. I've been trying to convince you to quit smoking, drinking, and over-eating . . . not for my good, but for yours. I've been trying to get you to think and be active . . . to read magazines and books, to go into business for yourself as an entrepreneur so money won't be as much of a problem. Most of my life I haven't had much money, but I've never cared. And when I do have it I mostly spend it putting other people into business.

I love it when I meet hams who tell me that I've had a positive influence on their lives. If everyone would make an effort to move the world ahead just a little instead of taking a free ride, we'd gradually see things getting better. I don't think we're seeing that. I look back on what I've accomplished, not so much to brag or exaggerate my influence, but to say, hey, you can do anything I've done. Just try.

The cellular telephone industry was inevitable, but I think I helped speed its arrival. Ditto the personal computer,

and the compact disc. Now I'm trying to jump-start the cold fusion Industry, plus get the word out that AIDS is curable, even in its late stages.

I wish I had more time to write. I've gotten tons more things to write. I'll list some of the stuff I've got done in Uncle Wayne's Bookshelf.

Now and then a reader corners someone who's worked for me and wants to know what the real Wayne Green is like. There are no hidden agendas. What you're reading is just like talking with me, only for some reason you don't bother to talk back. Well, write. No tapes, puhleeze. Gawd, I hate getting chatty cassettes. Or phone calls. Hey, my other line is ringing, gotta go.

Solving the Code Problem

The International Telecommunications Union (ITU) requires a knowedge of Morse code for our ham licenses. Their rules don't say anything whatever about 10 words per minute or 13, or even 20. Just a knowledge. So why are we beating ourselves over the head with a lead pipe over this thing?

The fact of the matter is that even a semi-brain-dead dweeb can learn the letters, numbers and punctuation in about an hour. I learned 'em one night as a kid in about a half hour while I was getting dressed in my Boy Scout uniform for a Troop 34 meeting in Brooklyn. Once you know the characters, you can "copy" at five words per minute. All you have to do, as I've explained several times before, is write down the dots and dashes, which is simple to do at that stupid speed. Then you can decipher 'em in your own sweet time. There's no time limit on the ham exams. If a VEC tries to rush you, report him for speeding.

So, if the encrusted old-timers in our hobby . . . for Instance the ones who dominate the ARRL board . . . insist on keeping the code as part of the license test, let's at least get it down to five-per for all license classes so newcomers can get it out of the way with an hour's work. From there on, if it's fun to use, we'll use it.

But do you have any leverage on the ARRL directors? You bet your sweet bippy you do. Their mantra is to join the League so you can have a voice. As with most things we hear from officialdom, the exact opposite is true. As soon as they have your money, your leverage is zilch. The only power you have with the League is when you withhold your "dues." If enough people refuse to be members I guarantee you'll see an emergency board meeting and a fast change of policy. I know of no other way you can influence these old turkeys. I know many of these guys and I'll tell you right now that most of them hold the members in contempt. It's the nonmembers that worry them. Make sense?

There isn't one major problem with amateur radio today that couldn't be solved if the directors gave a hoot about the hobby. They talk the talk, but they don't walk the walk. Meanwhile our growth is slow, our bands a mess, and the FCC is auctioning off our most valuable yet unused frequencies.

Read the Fine Print

I could hardly believe my ears! Only one person at the recent Dallas Hamfest said anything about how small the print is in my editorials. Now, just in case this has been annoying you, let me explain.

When anyone says anything about the small print the first thing I do is whip out the glasses from my shirt pocket. If you shop around a little, all it takes is five lousy bucks and you'll be able to read the fine print as easily as I do. The discount stores have reading glass specials every now and then. I really hate paying $12 for reading glasses when they sell them for $5 every so often.

Oh, it took me a while to figure out the glasses con. When I suddenly lost my eyesight, I went to an eye doc and went the usual route. Two hundred bucks for a pair of nice glasses. Holy zorch! And of course I kept dropping them every time I leaned over to pick up a penny, ever in search of that elusive good luck. And this scratched the lenses. Or I'd sit on 'em when they were on the bed. Or step on 'em when I got out of bed.

All that got expensive for a seven-generation skinflint of Scotch ancestry. Then I discovered that I could get the same glasses in Hong Kong for only $100, complete with automatic darkening lenses when I was in the sun. The glasses stores there even have a machine that checks your eyes for your prescription. I was getting over to Hong Kong every year leading a group of electronic business people to the yearly electronics shows in Tokyo or Osaka, Seoul, Taipei, and Hong Kong (we had two to three hundred going over for the two-week tour every October) so I had no problem getting bargain glasses.

Then I read somewhere that those reading glasses in discount stores are just as good, so I tried a pair. My eyes needed +2.5 to bring everything into focus. These days it's +3.0 for reading and +2.0 for the farther-away computer work. At five bucks, if I step on 'em, it's no big deal. Crunch. Actually, since they're made of plastic, it doesn't seem to hurt 'em.

Anyway, when you get older your eyes need some help, or you need longer arms.

If you're a new reader, you don't know the story of how I lost my eyesight. I lost it all at once. Before that I'd always had exceptional vision. I could read the gag business cards with one-point type. I could read signs two blocks away that were a blur to everyone else. Then it happened.

In my teens I bloated up and got fat. And I stayed fat, despite heroic dieting efforts. The old seesaw of "lose 20 pounds, gain 25." I dieted. I fasted. My weight went up and down, but more up than down. So one day I read about this great new diet where I could concentrate on eating protein. And when I felt hungry, all I'd have to do was drink diet soda pop. Hey, cool stuff! They were using saccharine to make the junk taste sweet in those days. I bought a few half-gallons of diet soda and got going on my new diet. And it worked, I didn't feel hungry after chugalugging the no-cal goop.

Then, along about the third day of the diet I noticed that it was getting difficult to read the print In pocket books. Hmm. The next day typewriter type was getting fuzzy. By the fifth day the headlines were blurring out. Time to stop all this before I go blind. When I stopped drinking the no-cal stuff my eyes stopped getting worse, but they didn't get better either. That's when I got my first pair of glasses. That was about 25 years ago and my eyes never got any better, so I've been a prisoner of reading glasses ever since.

At the time I wrote about my experience in my editorial. It was timely because a couple months later there was a big fuss about the damage that saccharine could do and it pretty much was phased out as a sweetener.

The eye doctors all explained that it was just me getting older that made me need glasses. Yeah? So how did all this happen in five days? Some day I suppose we'll find out that the saccharine makers knew about all this and kept it a secret. Meanwhile I've been a little leery of substitute chemicals. Some day we may learn that Nutri-Sweet also can produce health problems and the manufacturers knew it. Serves us right for trying to cheat Mother Nature (aka God).

Anyway, spend the lousy five bucks and get some glasses once you find your arms getting short or my editorials in too fine a print to read comfortably. It's bad enough that I fill three or four pages with my mice-type stuff, if we printed it in type-for-the-blind it'd fill eight to 10 pages and we'd have to change it to *Uncle Wayne's Trivia Magazine.*

Oh yes, I solved my fat problem by taking off 85 pounds over a seven-month period and then changing my eating habits. I haven't had to diet much since then, and that was over 20 years ago.

One more glasses hint: They're all put together with little screws which eventually start unscrewing and falling out. Most of the time you can find the tiny screw and put it back in again. I think they use screws because this forces so many people to go to a glasses store for the repair. Well, there's a way to end that frustration. The next time a screw pops out, leave it lay and replace it with a short length of paper clip wire, crimped at the ends. It isn't elegant, but it'll never fall out. You've got some diagonals and long-nosed pliers which will do the job in a minute.

Dear Occupant:

Your body is designed with remarkable restorative powers. It's enormously over-designed for survival. It's able to keep going and repairing itself fairly well despite constant high stress, an input of coffee, Danish, burgers, fries, malts, and Coca Cola. Despite a lack of exercise, tons of beer and pretzels, a lack of sleep, an ungodly Intake of chemicals via food preservatives, your water supply (which brings you fluoride, chlorine, lead, etc.) and pharmaceuticals. Even highly addictive and destructive drugs such as alcohol, nicotine, cocaine, and so on. It keeps going even when deprived of the ultraviolet light It was designed to need, and in the presence of electromagnetic fields which interfere with the ability of its cells to communicate. It does its best to keep going despite steady infusions of deadly poisons such as mercury, silver, and nickel via dental fillings. Even with all these destructive things most bodies are able to keep going for 50-60 years, a demonstration of the incredible repair system which is built in.

Sure, there are some genetically influenced repair problems which result in lowered performance. But most of these can be avoided if the occupant observes known health rules.

Oh, we know we'll live longer and healthier if we eat right, avoid drugs, exercise, get enough sleep, keep our stress to a minimum, and drink eight glasses of water a day. We know it, but we keep putting all that off until tomorrow . . . the tomorrow that doesn't ever quite come.

We know now that we can have healthier, more intelligent, and better kids if we give them a good start. And that means not screwing up our sperm and ova with drugs or magnetic fields *before* conception. It means being careful during pregnancy of magnetic fields, eating right, avoiding drugs and other chemicals, and avoiding stress or physical pain to the fetus.

We know that we've really screwed up the first year of life for most children by separating the baby from the mother. We know that few of our child-care facilities are worth the powder to blow them to hell. We know that our schools are a major disaster. And we know what damage most fast food does to bodies, yet there we are, at McDonald's, queuing up at the counter, and not for their salads, either.

When we're young we think we're immortal. When we get older and, in a few rare cases, wiser, it's too late. Yes, it's difficult to know what's best to do. We have the cigarette companies telling us how wonderful their product is, and that they've seen no evidence that convinces them that smoking is harmful. We have an endless bunch of people selling baloney diets, cures, and nostrums. We know we can't trust the government on anything, so where can we turn for information or help?

Our lives are filled with religion, ball games, soap operas, and "news" programs, helping us pass the time until our lousy diet, stress, or perhaps spending too many hours too close to our linear amplifier whisk us on to whatever next world awaits. Repent! Well, at least patronize that marvelous Wendy's salad bar more often, and hold the lousy fries.

Number 23 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check Special Events File Area #11 on our BBS (603-924-9343). for listings that were too late to get into publication.

SEP 2-3

NEW ORLEANS, LA The New Orleans Internat'l DX Convention will be held at Royal Sonesta Hotel on Bourbon St. Times: Fri., Sep. 2nd, 1 PM-11 PM; Sat., Sep. 3rd, 8 AM-Midnight. Registration deadline is Aug. 15th. For more info, call *(504) 283-4143 days only; FAX (504) 524-2129.* Send checks or money orders payable to: *New Orleans Internat'l DX Convention, c/o Michael Mayer W5ZPA, 5836 Marcia Ave., New Orleans LA 70124.*

SEP 4

ALAMOGORDO, NM The Alamogordo ARC, Inc. will sponsor VE Exams at 9 AM at the New Mexico State Univ. -Alamagordo, in the Pro-Tech Bldg. Electronics Lab. For further info, call *Ole WA5IPS, (505) 437-5896.*

SEP 10

CLIFTON PARK, NY "Hamfest 94" will be held at the County Fairgrounds in Ballston Spa NY, from 7 AM-3PM. Sponsored by the Saratoga County RACES Assn., Inc. Set-up Fri., Sep. 9th, 7 PM-8:30 PM. Talk-in on the WA2UMX Rptrs., 146.40/147.00 and 147.84/.24. Contact *N2FEP, P.O. Box 41, Rock City Falls NY 12863.*

ERIE, PA "Erie Hamfest '94," sponsored by the Radio Assn. of Erie, will be held 8 AM-2 PM at Franklin Twp. Fire Hall. Set-up at 5:30 AM. VE Exams at 9 AM at Franklin Center Methodist Church. Talk-in on 146.01/.61. Contact *Tom McClain N3HPR, 3954 Solar Dr., Erie PA 16506. Tel. (814) 833-1640.*

FORT WAYNE, IN "Summit City Computer Show/Hamfest" will be held by The Fort Wayne RC, from 8 AM-2 PM at Allen County 4-H Fairgrounds. Talk-in on W9TE 146.16/.76. Contact *John Goller K9UWA, 4836 Ranch Rd., Leo IN 46765. Tel. (219) 637-6426.*

TOPEKA, KS The North East Kansas ARC will hold their 5th annual event ('FEST 1994) at Knights of Columbus, Grand Hall. Hours: 9 AM-3 PM. ARRL Forum. VE Exams. Silent Key Equip. Auction. More. Talk-in on 146.355/.955 WV0S Rptr. Tables by advance registration only. Contact *Rob Nall WV0S, 5707 SW 28th Terrace, Topeka KS 66614-2420. Tel. (913) 271-8899.*

UNIONTOWN, PA The Uniontown ARC will hold their 45th annual Gabfest on the club grounds on Old Pittsburgh Rd., starting at 8 AM. Talk-in on 147.045(+) and 147.255(+). Contact *Carl or Joyce, (304) 594-3779.*

SEP 11

BOLINGBROOK, IL The Bolingbrook ARS will hold its 10th annual Hamfest/Computer Fair at the Inwood Rec. Center, 3000 W. Jefferson St. (Rt. 52), Joliet, IL. Time: 8 AM-3 PM. VE Exams 9 AM-noon. Talk-in on 147.33(+) kHz and 224.54(-) MHz. For details, call *(708) 759-7005.*

BUTLER, PA A Special Event will be held at the Butler Farm Show Grounds from 8 AM-4 PM. For details, contact *Joe Stalhman WA3BVQ, 499 Kiester Rd., Slippery Rock PA 16057. Tel. (412) 794-8383.*

DUBUQUE, IA The Great River ARC, Iowa Antique RC and Historical Soc., and two computer users groups will cosponsor a Hamfest/Radiofest/Computer Expo at the Tri-State Blind Soc., 3333 Asbury Rd. Time: 8 AM-3 PM. Talk-in on 147.84/.24. Contact *Loren Heber N0YHZ, 9479 Lauderville Rd., Dubuque IA 52003* or *Jerry Ehlers N0NLU, 3115 Brunswick St., Dubuque IA 52001. Tel. (319) 583-1016.*

GAITHERSBURGH, MD The 37th annual F.A.R. FEST '94 will be presented by The Foundation for Amateur Radio, Inc. The event will be held at the Montgomery County Agri. Center. Talk-in on 146.955(-), 443.400(+) and 146.52. VE Exams at 9 AM (by the Laurel VEC's). Computers and software. Commercial bldg. open at 8 AM. Contact *Mary Morris, (703) 971-3905;* or *Al Brown, (301) 490-3118.*

MONETT, MO The Ozarks ARS Hamfest/Picnic will be held at Monett City Pk. Potluck Dinner at 12:30 PM. Talk-in on 146.97. Contact *Stan KF0KS, (417) 452-3801.*

SOUTH DARTMOUTH, MA The South Eastern Mass ARA will hold their 7th annual Hamfest/Flea Market from 8 AM-3 PM at the club grounds at 54 Donald St. Talk-in on 147.00/.60. Contact *Michael Enos, P.O. Box 79064, N. Dartmouth MA 02747.*

SUFFERN, NY The ARRL Hudson Div. Convention will be held at the Rockland Comm. College Field House, beginning at 9 AM. ARRL President George Wilson W4OYI, and staff members from ARRL Headquarters, will be among the featured guests. Flea Market. More. Talk-in on 147.165/.765. Vendors ONLY may call the convention's special Vendor Info Line at *(914) 426-1488.*

SEP 17

BERWICK, PA The Columbia Montour ARC will host a Hamfest/Computerfest at Nescopeck Township Firehall Grounds, starting at 8 AM. Tailgating setup at 6 AM. *VE Exams at* 10 AM; Walk-ins welcome. Talk-in on 147.225(+), and 146.52 simplex. Contact *Dave WC3A, (717) 752-6851.*

GONZALES, LA "Gonzales Hamfest '94" will be held at the Gonzales Rec. Center from 8 AM-3 PM. Sponsor: The Ascension ARC. Talk-in on 147.225(+), CTCSS 107.2. Contact *George Turner KB5EOC, 16179 Gaives Ave., Prairieville LA 70769. Tel. (504) 622-3598.*

SANTA ROSA, CA Sonoma County Radio Amateurs, Inc. will hold their 12th annual Ham Radio Flea Market from 7:30 AM-2 PM at the Holy Ghost Hall, 7960 Mill Station Rd., just off Hwy 116 north of Sebastopol. Set-up at 6:30 AM. Talk-in on 146.13/.73. For tickets and info, write to *SCRA, Box 116, Santa Rosa CA 95402.*

RANDOLPH, VT The Central Vermont ARC will host the "Fall Foliage Hamfest/Computer Fair" from 9 AM-3 PM at the Judd Gym. at Vermont Tech. College. VE Exams at 12:30 PM. Forums. Talk-in on 147.09/.69/R, 146.625/.025/R, and 146.52 simplex. For reservations, make checks payable to: *Central Vermont ARC,* and send to *Tom Girardi WA1YNU, P.O. Box 261, Waterbury VT 05676. Tel. (802) 244-7836;* or *Steve Allen KD1UP, RR1 Box 2409, Moretown VT 05660. Tel. (802) 496-7696.*

SANTA FE, NM The 1994 Northern New Mexico Hamfest, sponsored by the Northern NM ARC, will be held at Glorieta Baptist Conf. Center. Talk-in on 145.19 (144.59 input), 147.90/.30, and 146.52/.52. For camping reservations, contact the *Glorieta Baptist Conf. Center, P.O. Box 8, Glorieta NM 87535.* For hotel info., call *(505) 757-6161.* For hamfest details, contact *Helenrose Burke W5IXS, P.O. Box 73, Ojo Sarco NM 87550. Tel. (505) 689-2367.*

SCOTTSDALE, AZ The Family AR Event will hold its 2nd annual event at Rawhide Western Town, 23023 N. Scottsdale Rd. RC airplane demo. Weathersat Forums. Emergency Ham Radio. Activities for children. Swap meet area opens at 6 AM. Exhibit hall opens at 9 AM. Contact *Len Winkler KB7LPW, P.O. Box 9219, Phoenix AZ 85068. Tel. (602) 861-0303.*

SEP 17-18

VIRGINIA BEACH, VA The ARRL Roanoke Div. Convention and Virginia Beach Hamfest/Computer Fair will be held at the Virginia Beach Pavilion. For commercial booths, contact *Lewis Steingold W4BLO, 1008 Crabbers Cove Ln., Virginia Beach VA 23452,* or call *(804) 486-3800.* For tickets and tables, contact *Manny Steiner K4DOR, 3512 Olympia Ln., Virginia Beach VA 23452. Tel. (804) HAM-FEST.*

SEP 18

ADRIAN, MI The AARC Hamfest/Computer Show will be held at Lenawee County Fairground 8 AM-2 PM. VE Exams; walk-ins OK. Talk-in on 145.37(-). Get more details from *Greg KZ8X, 4281 Mohawk Trail, Adrian MI 49221. Tel. (517) 263-1153.*

CLEMENS, MI The 22nd annual L'Anse Creuse ARC Swap and Shop will be held from 8 AM-2 PM at L'Anse *Creuse* H.S. VE Exams at 11 AM. Contact *Don Olszewski WA8IZV, (810) 294-1567: Prodigy ID# SSTG41a.* Talk-in on the ECHO Rptr., 147.08/.68 MHz, or on 146.52 MHz simplex. For info, send SASE to *Dave Harrington N8NLK, 165 Crocker Blvd, Mt. Clemens MI 48043-2546. Tel. (810) 465-2797.*

LAUREL SPRINGS, NJ The 46th annual South Jersey RA, Inc. "HAMfest" will be held at Pennsauken H.S. starting at 8 AM. Reserve spaces by contacting *Diane Narfis N2LCQ, 17 Roosevelt Dr., Laurel Springs NJ 08021. Tel. (609) 227-6281.* VE Exams on a walk-in basis 9:30 AM until ???. Talk-in begins at 7 AM on the day of the event, on 145.290 (-600).

NEWTOWN, CT The Western CT Hamfest will be sponsored by the Candlewood ARA from 8 AM-1 PM at the Edmond Town Hall, Rt 6. Flea Market. Displays. Talk-in on 147.12(+). Contact *Ken Weith KD1DD, Box 3441, Danbury CT 06813. Tel. (203) 743-9181.*

SEP 24

ELMIRA, NY The Elmira ARA will present the 19th annual Internat'l Hamfest/Computerfest at the Chemung County Fairgrounds, Horseheads NY, from 6 AM-4 PM. Flea Market. QSL Contest. VE Exams; contact *Bill, (607) 962-1134.* To purchase tickets, contact *Dave Lewis, RD1 Box 191, Van Etten NY 14889. Tel. (607) 589-4523.* Dealers, contact *Jay, (607) 733-0761.* Talk-in on Rookies Rptr. 147.96/.36 and 444.20.

SEP 25

FRAMINGHAM, MA The Framingham ARA will hold its Fall Flea Market and VE Exams at Framingham H.S. (on A Street). Doors open at 9 AM to early bird buyers, and 10 AM to all buyers. To reserve tables contact *Lew Nyman K1AZE, (508) 879-7456.* Make checks payable to *FARA, P.O. Box 3005, Framingham MA 01701.* To register for exams, send check for $5.75, payable to *ARRL/VEC,* to *Dick Marshall WA1KUG, 37 Lyman Rd., Framingham MA 01701.* Walk-ins not accepted after 10 AM. Talk-in on 147.15 rptr.

LONGMONT, CO A Hamfest will be sponsored by the Boulder ARC, beginning at 8 AM at Boulder County Fairgrounds Exhibition Bldg., Nelson & Hover Rds. VE Exams. Talk-in on 146.70(-) and 147.27(+). To reserve tables, contact *BARC, P.O. Box 2033, Boulder CO 80306-2033. Tel. (303) 441-3883.*

ST. PETERS, MO St. Peters ARC Swapfest will be held from 7 AM-1 PM at St. Charles County Comm. College Campus, 4601 Mid Rivers Mall Dr. Flea Market. Talk-in on 145.41 MHz and 444.275 MHz. Contact *Jay Underdown W0OGS, 58 Judy Dr., St. Charles MO 63301. Tel. (314) 723-4200.*

YONKERS, NY A Giant Electronic Flea Market, sponsored by the Metro 70cm. Network, will be held at Lincoln H.S. on Kneeland Ave. from 9 AM-3 PM. VE Exams. Talk-in on 440.425 MHz PL 156.7, 223.760 MHz PL 67.0, 146.910 Hz, 443.350 MHz PL 156.7. Contact *Otto Supliski WB2SLO, (914) 969-1053.*

OCT 1-2

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL KY State Conv. will be held at the Commonwealth Conv. Center in downtown Louisville. Mail requests for tickets or info to *The Greater Louisville Hamfest Assn., P.O. Box 34444-Q, Louisville KY 40232-4444.* For commercial spaces, call *(812) 948-0037;* Flea Market spaces, *(812) 282-4898.*

OCT 2

HUNTINGTON, IN The Huntington County ARS will sponsor its 6th annual Hamfest from 8 AM-1 PM at the PAL (Police Athletic League) Club. Set-up at 6 AM. VE Exams. Flea Market. Talk-in on 146.085/.685 and 448.975/443.975. Contact *Chris Richardson N9QVI, P.O. Box 284, Huntington IN 46750. Tel. (219) 356-0319.*

SAN DIEGO, CA Over a dozen San Diego ARCs, the American Red Cross, and the Salvation Army, will stage the 3rd annual "Ham Radio Roundup." Location: Missile Pk., Missile Rd. & Clairemont Mesa Blvd. Each club or agency (ARRL, MARS, and others) will display the various aspects of amateur radio. Set-up begins at 7 AM; gates open at 10 AM. Contact *Harry A. Hodges WA6YOO, (619) 743-4212.*

SPECIAL EVENT STATIONS

AUG 14

FULTON, NY The Oswego County AR Emergency Serv. will operate Station KC2QV 1200Z-2100Z from Fulton's annual Riverfest. Operation will be in the middle of the General 80, 40, 20, 15, and 10 meter phone bands, the Novice portion of 10 meters, and 147.75/.15 MHz. For a certificate, send your OSL card and a large SASE to *KC2QV, 366 South Fifth St., Fulton NY 13069.*

AUG 19-SEP 5

ISLINGTON, ONT., CANADA Amateur Radio clubs around Toronto Canada will operate Station VE3CNE 1400Z-0200Z each day as part of the Canadian Nat'l Exhibition in Toronto. Freq.: CW - 80 meters: 3.645/.700 MHz; 40 meters: 7.045/.145 MHz; 20 meters: 14.045; 15 meters: 21.045/.145 MHz. SSB - 80 meters: 3.745/.865 MHz; 40 meters: 7.065/.235 MHz.; 20 meters: 14.145/.245 MHz; and 21.345 on 15 meters. Talk-in on 145.410 MHz. Contact *(416) 393-6000* for more details.

SEP 1-5

MT. PLEASANT, IA Station WOMME will be operated by the Mt. Pleasant ARC during the Midwest Old Threshers Reunion. Voice and CW operation will be in the General portion of 80-10 meters. For a OSL, send an SASE to *Dave Schneider WD0ENR, RR3 Box 307A, Mt. Pleasant IA 52641.*

SEP 2-4

HAGERSTOWN, MD The Antietam Radio Assn. will operate Club Station W3CWC to commemorate the 125th Anniversary of the birth of Hiram P. Maxim W1AW, Founder of the ARRL. They will also celebrate the installation of a brass headmarker at his grave site in Rose Hill Cemetery. Operation will be from 1500Z Sep. 2nd-0400Z Sep. 3rd; also, 1200Z Sep. 3rd-2400Z Sep. 4th. Freq.: CW - 3.640, 7.045, 14.040, 21.040, 28.040. SSB - 3.920, 7.240, 14.240, 21.295, 28.350 MHz. For a commemorative certificate, send your QSL and an SASE to *Antietam Radio Assn., Attn: Special Event Station W3CWC, P.O. Box 52, Hagerstown MD 21741-0052.*

SEP 4

PANAMA, REP of PANAMA The 23rd Anniversary Contest of Radio Club Panama will take place 0001 GMT-2359 GMT. For details, contact *Radio Club Panama, Anniversary Contest, P.O. Box 10745, Panama 4, Republic of Panama. Fax: (507) 26-4477. Packet:HP.1COO@HP.1CDW.#PANCTY.PA N.CEAM.*

SEP 4-5

AUBURN, IN The Northeastern Indiana ARC will operate a Special Event Station to commemorate Auburn Cord Duesenberg Days. Operations will be 1400Z-2200Z in the lower 25 kHz of the General bands on 40 meters and/or 80 meters. For a commemorative QSL, send confirmation and SASE to *NEIARC, P.O. Box 745, Auburn IN 46706.*

SEP 10

GREELEY, CO The Weld ARS will operate Station WA0DDC from 1600Z-2100Z, to celebrate Potato Day at Centennial Village. Frequencies: 14.250 MHz and 28.490 MHz. For a certificate, send your QSL, with a business size SASE to *Rick Hubbard WA0DDC, P.O. Box 5116, Greeley CO 80631.*

SEP 10-11

NORWALK, CT The Greater Norwalk ARC will operate KA1OFN 1300Z-2100Z Sep. 10th, and 1300Z-1900Z Sep. 11th, to celebrate the 17th Annual Norwalk Oyster Festival. Operation will be in the lower 25 kHz of the General phone band, on 40, 20 and 15 meters, and on the Novice 10 meter phone subband. For a certificate, send a OSL card and a 9" x 12" SASE to the *Greater Norwalk ARC, 324-7 Main Ave., Box 115, Norwalk CT 06851.*

SAXONBURG, PA The Butler Co. AR Public Serv. Group will operate KD3RT to honor the Mayor of Saxonburg, Reldon Cooper W3SYV, 1400Z-2200Z Sep. 10th, and 1400Z-2000Z Sep. 11th. Location: Saxonburg Festival of the Arts. Phone will be on the lower portion of the 40 and 20 meter General subbands. For a certificate, send a 9" x 12" SASE to *BCARPSG, Inc., P.O. Box 1692, Butler PA 16003.*

SEP 10-16

MAASTRICHT, THE NETHERLANDS During World War II, the German occupation of Maastricht ended on Sep. 14th, 1944. Maastricht was the first city in the Netherlands to be liberated. The operation was carried out by the 30th Infantry Div. of the 19th US Army Corps, Old Hickory Div. In commemoration of this occasion, Station PA6OHD (Old Hickory Div.) will be in operation in the lower portion of 20 and 15 meters, phone and CW.

SEP 12-17

LINWOOD, NJ The Southern Counties ARA will operate K2BR from the Miss America Pageant in Atlantic City (Absecon IS., IOTA: NA 111). Freq.: Phone - 25 kHz inside lower General class bandedge; CW - 65 kHz inside lower General class bandedge; Novice - 28.100/.500 kHz. Operation will begin 10 AM EST on Sep. 12th. QSL - SASE via *SCARA, P.O. Box 121, Linwood NJ 08221.*

SEP 15-20

THE NETHERLANDS The Nijmegen RAC will operate Station PA6OMG to commemorate the Sep. 17. 1944 paratrooper effort to secure bridges in preparation for the advance of the British Army over Dutch waterways (Operation Market Garden). PA6OMG will operate in CW and phone on all HF bands during the week. If possible, WWII radio equipment will be used to make connections. Send QSL cards to *QSL Manager, PA0KHS, NL-Region 35,* via the Dutch QSL-bureau. For local visitors, a 2m and 70cm talk-in will be on standby. A QSO with PA6OMG will be valid for the Noviomagum Certificate.

SEP 16-18

CHARLESTON, SC The Charleston ARS will operate WA4USN 1300Z-2300Z to commemorate the BOC Challenge 1994-95, a single-handed round-the-world yacht race. Freq.: 7.250, 14.045, 14.250, 21.045, 21.250, the Novice CW portion of the 40 meter band, and 146.790. All frequencies +/- 5 for QRM. 2 meter operation on Sep. 17th only. For a QSL, send QSL and SASE to *Sheila Frank KC4UDD, 614 Longstreet Circle, Summerville SC 29483.*

SEP 17

NEGAUNEE, MI The Hiawathia ARC will operate W3KGW 1300Z-2030Z to commemorate the 150th Anniversary of the locating of iron ore on the Marquette Range. Operation will be on the General band and on 146.91. Send QSL and SASE to *Charles Waters, 970 N. Westwood Dr., Ishpeming MI 49849.* Please put contact number on envelope.

PARK CITY, UT The Mercury ARA, in cooperation with the Great Salt Lake Council of the Boy Scouts of America, will operate K2BSA/7 during the Utah Heritage Jamboral. Operation will be from 0000Z-1800Z. Freq.: 3.870, 7228, 14287, 21395. Send QSL and SASE to *MARA, P.O. Box 11201, Sail Lake City UT 84147-0201.*

SEP 17-18

READING, PA Berks ARS will operate WA3MFT from 1600Z Sep. 17th-2000Z Sep. 18th, to commemorate the renovation to the landmark PAGODA. Phone frequencies: 3.880, 7.280, 14.280, 21.380, 28.480; packet on 145.09. For a certificate, send your QSL and a 9" x 12" SASE to *Berks Amateur Radio Soc., P.O. Box 12632, Reading PA 19604.*

SEP 19

DANVILLE, PA Liberty-Valley Elementary School will operate WC3A, N3IRN, and N3LQS on all amateur bands, from 1300Z-1900Z. For a certificate, send your QSL to *D. Miguelez N3POB, Liberty-Valley School, 175 Liberty-Valley Rd., Danville PA 17821.*

SEP 20-24

CHALK RIVER, ONT., CANADA The Renfrew County ARC will operate Station CJ3IPM to commemorate the Internat'l Plowing Match coming to Renfrew county for the first time. The RCARC will operate on all bands, and a QSL card is available by sending an SASE to *RCARC, P.O. Box 39, Chalk River, Ont., Canada K0J 1K0.*

SEP 23-25

PEA PATCH ISLAND, DE The Tri-County Amateur Group will operate KD3XN 1400 UTC-2100 UTC from the Civil War's historic Fort Delaware. Operations will be in the General and Novice portions of 10, 12, 15, 17, 20 and 40 meters. For an overhead photo QSL, send an SASE to the operator worked.

WALLA WALLA, WA The B.P.O. ELKS Lodge #287 is celebrating its 100th Anniversary. They will issue a certificate for working 5 Walla Walla stations. Please send names and calls on your QSL card to *Robbie Gallo KB7OBW, 351 E. Rose, Walla Walla WA 99362.* Please also send a 9" x 12" SASE.

SEP 24

ADDISON COUNTY, VT The Addison County ARA will operate N1BBR and WX1O from 1400Z-2100Z, to celebrate the Apple Harvest in VT. Operation will be in the General portion of the 20 and 40 meter CW and phone bands, as well as the Novice 10 meter phone band. Operation and talk-ins on local 2 meter rptrs. If all goes as planned, an AM antique station will run on approx. 14.285. For a certificate, send QSL info, $1 US, and a 9" x 12" SASE to *Elaine Eldridge N1IJW, P.O. Box 10, New Haven VT 05472-0010.*

ERWIN, TN The Unicoi County AR Serv. will operate AC4QF 1300Z-2100Z to commemorate the 15th annual Erwin/Unicoi County Apple Festival. Operation will be 14.265 and 7.265, phone only. For a QSL card, send QSL and a #10 SASE to *UCARS, P.O. Box 185, Erwin TN 37650-0185.*

SOUTH HOUSTON, TX The Pearland ARC will operate AB5GU as part of the city's Centennial celebration. Freq.: 28.410, 21.310, 14.260, 7.230, and 7.125. All school stations will be active during the preceding week. Jamieson M.S. will operate KI5MB; Pearland H.S. will operate KB5RGJ. Certificates will be sent to stations working all three locations. For QSL or a certificate, send an SASE via *Marty Haley AB5GU, 803 Ave. I, South Houston TX 77587.*

SEP 30-OCT 1

ISHPEMING, MI The Hiawatha ARA will operate Station KB8DNS Sep. 30th 1700 UTC-0200 UTC, and Oct. 1st 1500 UTC-2000 UTC. This is to commemorate the 40th Anniversary of the Nat'l. Ski Hall of Fame; and the 90th Anniversary of the U.S. Ski Assn. Freq.: General phone and CW Novice on 80, 75, 40, 15, 20, 10, and 2 meters. For a certificate, send a 9" x 12" SASE to *Rod KB8DNS, 1740 Rosewood Ln., Ishpeming MI 49849.*

OCT 1

ANAMOSA, IA The Jones County ARC will operate N0CWP 1500Z-2000Z, to celebrate their annual Pumpkinfest. Operation will be in the lower 50 kHz of the General subbands. For a certificate, send confirming QSL to *Jim McClintok N0CWP, Box 462, Morley IA 52312.*

OCT 1-2

PITTSBURGH, PA The Breezeshooters ARC will operate Station W3XX 1400Z-2100Z Oct. 1-2, from the submarine U.S.S. Requin, docked at the Carnegie Science Center. Operation will be CW on 7.123 and 21.123, and phone on 7.250, 14.250, 21.350, 28.460, and 146.52. For a certificate and QSL card, send QSL and an 8 1/2" x 11" SASE to *Ron Berry WB3LHD, 326 Sunset Dr., Bethel Pk., PA 15102.*

Number 24 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

I'm sure we all agree that propagation conditions for this past summer were very poor. This month, however, we may see some slight improvement as summertime thunderstorms and high absorption levels give way to the usually better autumn propagation on the HF bands.

First, the bad news: September 1-3, the 9th and 10th, the 12th-15th, and again the 26th, are likely to exhibit some disturbances in the ionosphere, hence Poor and sometimes Very Poor propagation conditions for DX and even for intra-country QSOs.

The good news, however, is that days of Good or Fair propagation on the HF bands will outnumber the others, and the chart will show which days to pick for your operations.

It's always worthwhile to occasionally monitor WWV at 18 minutes past any hour to obtain the latest values of Solar Flux (above 80 is best), Boulder A index (10 or below), and Boulder K index (2 or below). Try to plan your operating when the "numbers" are favorable for best results.

10 and 12 Meter Bands

Generally Poor conditions worldwide on most days, with occasional openings on exceptionally Good days to tropical areas during daylight hours. These bands will close before local darkness.

15 and 17 Meter Bands

Circuits to Africa and Central and South America from the Northern Hemisphere may be open on Good days, with some nice short skip openings out to 1,000 miles or so on these days.

20 and 30 Meter Bands

As usual, the 20 meter band ought to be your choice for any serious worldwide DX work between the hours of sunrise and sunset, local time. Also, this band should remain open until well after sunset for long openings into the Southern Hemisphere. Short skip to about 2,000 miles or so should be available on many days of the month.

The 30 meter band will act a little like 20 and a little like 40. Expect DX, il any, between sunset and sunrise, and expect fading to prevail on all paths. Signals from the east will peak between sunset and midnight (local time) and from the west between midnight and sunrise (local time). Daytime short skip out to 1,000 miles and nighttime short skip beyond 1,000 miles may be expected.

40 and 80 Meter Bands

Forty meters will behave much like the 30 meter band as shown above.

Eighty meters ought to provide some good DX between sunset and sunrise. Lessening of thunderstorm QRN will be welcome. Short skip during the day to 350 miles may be expected on Good days, while skip to 1,000 miles and beyond ought to prevail after dark, although I've found that even in September, high daytime signal absorption levels, peaking at noon or 1 p.m. local time, will preclude operations.

160 Meter Band

There won't be any daytime skip available, but short skip openings and DX openings to some areas of the world at night may be anticipated. Don't expect wonders, however, unless you have excellent antenna systems, such as Beverages for receiving and verticals for transmitting. DX, if any, should peak around midnight and again around sunrise. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20						20					15
ARGENTINA	20	40A	20	40					10		20A	20A
AUSTRALIA	20	40A		40	40	20	20	20		20	15	15
CANAL ZONE	40A	40A	40	40	40		20	20A	10	15A	20A	20
ENGLAND	40	40	40	40				15	20A	20		
HAWAII	20	20				20	20			15	15	15
INDIA						20	20	20				
JAPAN	20					40	20				15	15
MEXICO	40A	40A	40	40	40		20	20A	10	15A	20A	20
PHILIPPINES							20					
PUERTO RICO	40A	40A	40	40	40	20	20A	15A	15A	20A	20	40A
SOUTH AFRICA	40	40A	20					15A	15A	20A	20A	20A
USSR	20	20					20	15			20	20
WESTCOAST	20A	20	40	40	40	40	40	20	15	15A	15A	15A

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20			15	15
ARGENTINA	20	40	40	40						15A	20A	20A
AUSTRALIA					40	40	20	20	20		15	15
CANAL ZONE	40	40	40	40	40	20	20	15	15A	15A	15A	15
ENGLAND	40	40	40	40				15	15	20A	20	20
HAWAII	20	20	20	40	40		20	20		15	15	15
INDIA	20	20					20	20				
JAPAN	20					40	20	20				15
MEXICO	40	40	40	40	40	20	20	20	20	15A	15A	15
PHILIPPINES	20A	20					20	20			15	15
PUERTO RICO	40	40	40	40	40	20	20	20	20	15A	15A	15
SOUTH AFRICA							10	15A	15	20A	20A	20
USSR							20	20A	15	20	20	

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20A	20A	20			40	40	40A	20	20	20	20A
ARGENTINA	20A	20	40A	40						15A	15A	15A
AUSTRALIA	20A	20A	20	20	40	40	40		20	20	15	15
CANAL ZONE	20	20	40A	40A	40			20	20A	15A	15A	15A
ENGLAND			40					20	15	20A	20	20
HAWAII	15	20A	20A	40A	40	40	40	20	20	20		15A
INDIA	20A	20A						20	20			
JAPAN	20A	20A	20			40	40	40A	20	20	20	20A
MEXICO	20	20	40A	40A	40			20	20A	15A	15A	15A
PHILIPPINES	15			20		40	40		20	20		
PUERTO RICO	20	20	40A	40A	40			20	20A	15A	15A	15A
SOUTH AFRICA	20							20	20	15	20	20
USSR			40	40				20A	15A	10	20	20
EAST COAST	15A	20	40	40	40	40	40	20	15	15A	15A	15A

A=Next higher frequency band may also be useful. G=Good F=Fair P=Poor

SEPTEMBER 1994						
SUN	MON	TUE	WED	THU	FRI	SAT
				1 P	2 VP	3 VP-P
4 P-F	5 F	6 F-G	7 G-F	8 F-P	9 P	10 P-F
11 F	12 F-P	13 P	14 P	15 P-F	16 F-G	17 G
18 G-F	19 F-G	20 G	21 G	22 G	23 G	24 G-F
25 F-P	26 P	27 P-F	28 F	29 F-G	30 G	

Number 25 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Uso abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that ng you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Judy Walker, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the October classified ad section is August 11, 1994.

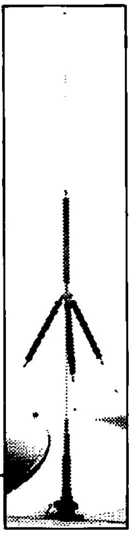
Continued on page 81

Number 26 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW

NCG COMET

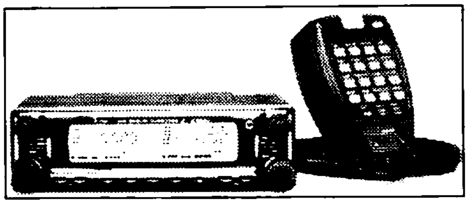


Comet Antenna has introduced the new Quad-Band HF mobile antenna, Model HA-4S, which is pictured on this month's cover. The following coils are standard with the HA-4S: 40, 15, 12, and 10 meters. An optional 20 meter coil is also available: the L-14HS.

The HA-4S is very compact and lightweight, weighing only 1 pound 14 ounces and measuring only 4 feet 10 inches tall. This allows for more convenient mounting options than conventional HF mobile antennas. The HA-4S can be mounted on a trunk lip-style mount such as the RS-820, or a rain gutter mount such as the RS-80.

High quality construction includes a gold-plated PL-259 connector at the antenna's base and a threaded collar that unscrews to expose the hinged base, allowing a 90-degree foldover for clearing garage doors, etc.

For more information on the HA-4S, visit your favorite dealer or contact *NCG Comet, 1275 North Grove St., Anaheim CA 92806; (714) 630-4541, FAX (714) 630-7024.* Or circle Reader Service No. 202.

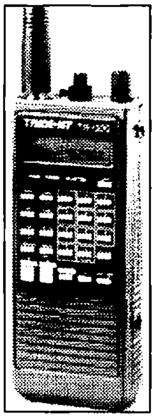


ICOM

Icom has introduced the IC-2700H dual-band mobile transceiver, featuring a detachable front panel. Mount the front panel on your vehicle's dashboard and store the main body in another location, using the optional OPC-438 or OPC-439 accessories. The careful design and dual controls allow for safe and convenient operating while driving.

The IC-2700H features VHF (144 to 148 MHz) and UHF (440 to 450 MHz) coverage, each band having its own tuning knob, Memory/Call button, and Volume/Squelch control. Four selectable backlighting conditions make for easy reading of the display. Full access to all functions are available from the supplied DTMF microphone. Adding the optional HM-90A wireless mike allows "backseat driver" control of the transceiver.

Each band has six scratchpad memories and the IC-2700H provides a total of 100 memory channels. Output power is 50 watts VHF and 35 watts UHF. The suggested retail price is $959. For more information, visit your Icom dealer or contact *Icom America, Inc., 2380-116th Avenue N.E., Bellevue WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.



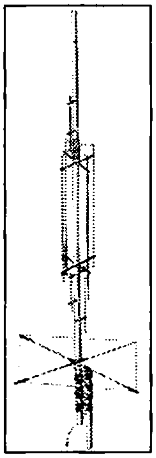
ACE TRIDENT

A new hand-held radio receiver covering shortwave and public service band voice frequencies has been introduced by Trident. Frequency coverage ranges from below AM broadcast (500 kHz) to above the new PCS frequencies (1.3 GHz) in the microwave range. Listeners can tune into virtually every kind of voice broadcast, from all over the world.

This new Trident demodulates AM, narrowband FM, and wideband FM signals. Frequencies can be directly entered in the keypad, or the unit will scan for active channels. The receiver has 1,000 permanent programmable memory channels.

The new Trident comes with a 12 VDC cigarette lighter plug, AC battery charger, four AA batteries, earphone, built-in speaker, belt clip, flexible antenna, mounting hardware, and instructions. For more information contact *Ace Communications, 10707 E. 106th Street, Fishers IN 46038; (800) 445-7717, FAX (800) 448-1084.* Or circle Reader Service No. 203.

GAP ANTENNA PRODUCTS



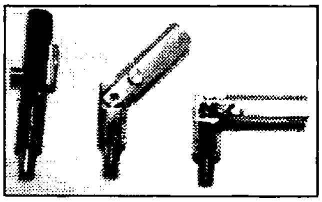
GAP Antennas has introduced the Titan DX multiband antenna. The Titan provides continuous coverage under 2:1, across the entire 10, 12, 15, 17, 20, 30, and 40 meter bands. Plus, it covers over 100 kHz on 80 meters. The Titan is pretuned; it needs no tuner.

The Titan is the answer for the amateur with space limitations. It's easy to set up, requiring no radials. It simply mounts on a 1-1/4" pipe. The Titan is a very manageable 25 feet and weighs 25 pounds.

Like all GAP antennas, the Titan has no traps or coils, but has the unique elevated GAP feed which dramatically reduces earth loss, noise, and instability. Sturdy construction features 8063 aluminum tubing and stainless steel hardware.

GAP antennas are manufactured in the USA. For more information visit your favorite dealer or contact *GAP Antenna Products, Inc., 6010 N. Old Dixie Highway, Vero Beach FL 32967; (407) 778-3728.* Or circle Reader Service No. 204.

ANTENNA SALES & ACCESSORIES



ASA has introduced the Fold-Over Model FO-1 three-position adapter for 3/8 x 24 thread antennas, which fits any 3/8 x 24 mount. This unique mount adapter eliminates having to take the antenna off the vehicle when approaching home garages, drive-up bank tellers, and parking garages.

Just push the side button on the FO-1 and fold over to 45 or 90 degrees.

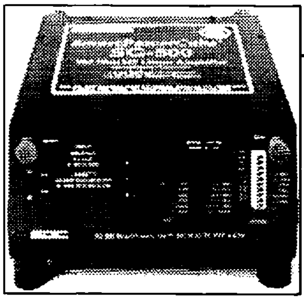
The heavy-duty unit is constructed of weatherproof chrome-plated brass and stainless steel. They are priced at $7 each or three for $20 (add $5 S & H USA, to one location). For more information contact *ASA, PO Box 3461, Myrtle Beach SC 29578; (800) 722-2681.* Or circle Reader Service No. 205.

OFS WEATHERFAX

OFS WeatherFAX has announced a third-generation weather satellite demodulator—the PCMCIA Convertible for laptop and desk computers. This is the first WeatherFAX decoder card to use Carrier Peak Sampling (CPS) technology, which provides noticeable improvements in image quality and clarity. Whites are whiter, blacks are blacker, gray shades are more accurate, and boundary edges are well-defined. The quartz crystal-locked digital design eliminates all adjustments, and self-test modes verify correct operation.

The compact PCMCIA Convertible is credit-card (PCMCIA Type II) sized and is hot-plugable into IBM compatible laptops and desktops, using the OFS ISA bus converter card. When attached to the audio output of an SSB or VHF receiver, it will acquire high quality weather satellite pictures directly from polar-orbiting and geostationary satellites and from HF Marine FAX.

Prices start at $495. For more information contact *OFS WeatherFAX, 6404 Lakerest Ct., Raleigh NC 27612; (919) 847-4545 (voice or FAX).* Or circle Reader Service No. 206.

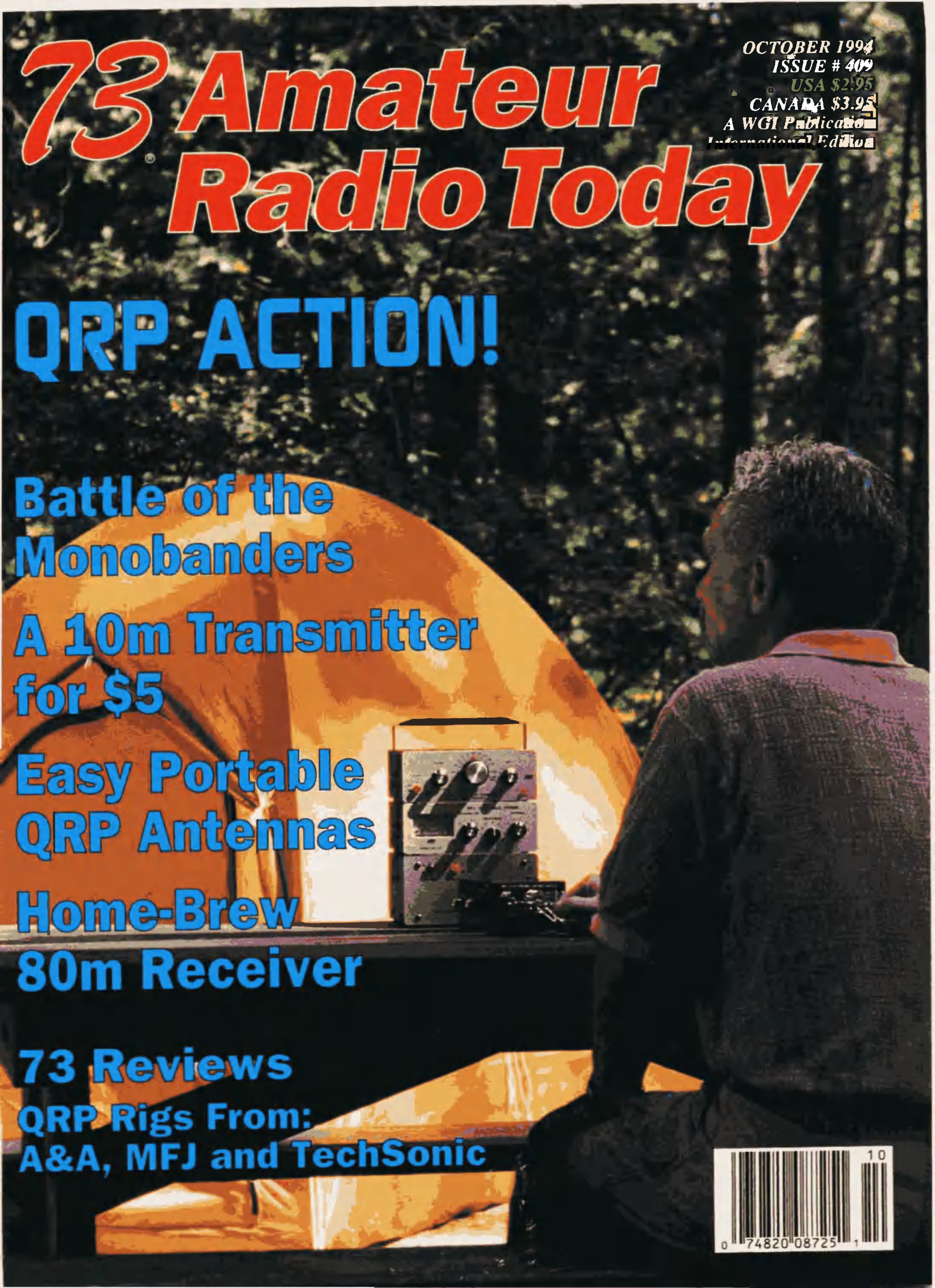


SGC

SGC has announced the availability of the new SmartPowerCube microprocessor-controlled linear amplifier. The unit significantly boosts power 500 watts intelligently. The unit has a bank of status LEDs on the front panel which function as Built-in Test Equipment (BITE) allowing the operator to spot any problem quickly.

The SmartPowerCube constantly monitors your HF SSB rig's activities, power needs, and antenna condition. In less than 15 milliseconds, it selects the right broadband filter. The unit is protected from preprogrammed shutdown procedures and shuts down automatically in the event of a microprocessor fault.

The SG-500 SmartPowerCube is designed for service in fixed, mobile, and marine applications, and is fully compatible with most HF equipment. The introductory price is $845 for a limited time. For more information contact *SGC Inc., SGC Building, 13737 SE 26th St., PO. Box 3526, Bellevue WA 98009; (206) 746-6310, (800) 259-7331, FAX (206) 746-6384.* Or circle Reader Service No. 207.



73 Amateur Radio Today

OCTOBER 1994
ISSUE # 409
USA $2.95
CANADA $3.95
A WGI Publication
International Edition

QRP ACTION!

Battle of the Monobanders

A 10m Transmitter for $5

Easy Portable QRP Antennas

Home-Brew 80m Receiver

73 Reviews

QRP Rigs From: A&A, MFJ and TechSonic

73 Amateur Radio Today

October 1994
Issue #409

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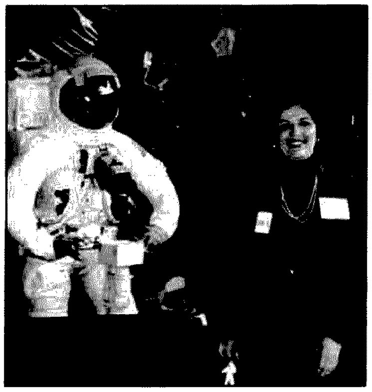

Will Carole Perry WB2MGP notice the astronaut sneaking up behind her before it is too late? *Turn to page 55 to find out!*

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

On the cover: 73 Advertising Sales Manager Dan Harper sends a low-power CQ from Greenfield, New Hampshire, State Park. Equipment courtesy of MFJ. (Photo by Charles Warrington WA1RZW.)

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Manuscripts Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon publication. A premium will be paid for accepted articles that have been submitted electronically (CompuServe ppn 70310,775) or on disk as an IBM-compatible ASCII file. You can also contact us at the 73 BBS at (603) 924-9343, 1200–19.2 Kb, 8 data bits, no parity, one stop bit. All contributions should be directed to the *73* editorial offices. "How to Write for *73*" guidelines are available upon request. US citizens must include their Social Security number with submitted manuscripts.

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Contract: By casting a glance at this insignificant type you are hereby commanded to Elmer a newcomer to ham radio. Help mold the future of our great hobby. Uncle Wayne will be very disappointed if you don't.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Are You a Plus or a Minus?

Have you been contributing to the world? In the ham radio field, have you been helping your local club to get kids licensed? Have you been helping the club meetings to be more fun and attract more members? Have you been contributing to the ham magazines? Maybe doing a club newsletter? Organizing events? Teaching theory? How about building electronic gadgets and writing 'em up?

Or have you been spending your time on the air grumbling about this and that? Adding misery to DX pileups? Jamming contacts? Venting your irritation to anyone who will listen?

There are plus people who are contributing to the world. These are the ones who are giving us poetry, music, art, magazines and books, and other creative things for our minds. There are those who are devoted to graffiti.

Are you busy learning, teaching and creating, or are you wasting your life with inconsequentials such as soap operas, talk shows, reading newspapers, watching sports (as opposed to doing them), and so on? Are you a spectator or a participant in life? Have you ever tried painting? Have you ever tried composing a song? Writing a poem?

The candy of life is temptingly everywhere, steering you away from the meat, potatoes and veggies which will make you healthier and happier in the long run. Most people are slaves to instant gratification. Oh, they know that a salad is better for their body, but for right now make that a cheeseburger, fries and a Coke. Nobody lives forever, right? That'll be something to think about when you are 73 and have emphysema, arthritis, and a walker, not something of any great concern right now.

How are you to live and work with? Are you making people happier? Among the bundles of nice letters I get from readers there are occasionally some nasties. Name-calling. These are from angry people, and I know that not one of them is living a happy life. They're stressing their families and co-workers. Angry people should never be allowed to represent a company on the telephone or in writing. Put them where they can't do the company harm with their attitude.

Well, enough for my sociological lecture today. Repent. Try writing a poem and see if you've still got some wonder and creativity left alive. How about trying your hand at your word processor on an article for *73* or *Radio Fun* telling about something you've done or made that other hams can enjoy? How about your adventures with your new rig? My Silent Key correspondents are adamant that you will get no credit whatever for having confirmed 350 countries, knowing baseball statistics, or having religiously watched a soap opera for 20 years. In fact, you might just get recycled to Burundi on the next go around, where there are only two hams listed in the *Callbook*, one with a French address and the other at the American embassy. Serve you right.

How about trying to shoot a cover photo for*73*? Now there's a challenge. That takes creativity and skill. Or perhaps doing an article with illustrations on some club activity for your club newsletter. Stop throwing your beer cans out your pickup window and organize clean-up teams for your town.

How many hams have you contacted recently who've said at the end, "Hey, you know, I've really enjoyed talking with you?"

Whadaya Read?

If you count up the total paid circulation of the three ham magazines; if you don't figure any overlap; even so, less than half of our licensed amateurs are bothering to read any ham magazines at all!

Now, is this because over half of us have no real interest in the hobby, or is it that perhaps the ham magazines suck? And that might even include *73*, since over 400,000 licensed hams are *not* reading it.

I suppose that the essentially brain-dead who are merely logging call letters, handles, and signal reports have no need for any information about other ham activities, are satisfied with their rigs and could care less about the new stuff coming out and so on. The whole idea of getting on packet or making satellite contacts is so far beyond their conception that magazine space devoted to these activities is irritating.

The next time you're on the air start asking the chaps you contact which ham magazines they read. Ask them which they enjoy the most; which they've found helps them learn more about technology; which has inspired them to try some new ham activity. Keep track and send me a copy of what you've discovered.

Beyond that I'd appreciate it if you'd take a good critical look at *73* and let me know how it shapes up for you on the above questions. We do have far more reports on new products than the other ham rags and publish them substantially sooner, but maybe you haven't noticed. It's fun to get something new now and then, and the readership surveys show top interest in reviews. We tend to steer away from heavy contest coverage, even though I myself enjoy them. Well, I used to, so I know what fun they can be, but I guess I contested out. *CQ* is so totally devoted to contests that I leave that small niche to them.

Maybe I'm too much of a nag on trying new aspects of the hobby. It's just that I've had so much fun learning and playing with RTTY, slow-scan, repeaters, 10 GHz, DXpeditioning, satellite contacts, and so on, that I want others to share in the fun. I'm an itch in my music magazines too, trying to get the readers off grunge and to at least try some ragtime, classical, bluegrass, and so on.

And there are so many fascinating things to talk about that I get frustrated when I get on the air and run into hams who refuse to talk. I don't give a hang what kind of a commercial antenna they've put up. I want to know what they do, what their interests are; where they've been, and so on. Maybe one of these days I can get Robot or some ham company to put a fax jack in their rigs so when I make a contact I can fax a list of things I like to talk about. And get one from him (or her?). The next step would be a packet transfer which my computer could check for items of mutual interest. Oh well, it's a thought.

Anyway, please drop me a note and let me know which ham rags you're reading. Tell me what you like about 'em, and what you don't. If you have any suggestions for my improving 73, let 'er rip. Which magazine has gotten you to try a new mode or band? Oh yes, you might mention which ham bands and modes you're using the most these days. Are you on any of the landline nets?

Taking Equipment Photos

When a ham gets through building a piece of equipment, or when a ham manufacturer needs a picture of his product to go with an ad or new product release, there is the sudden realization that taking a photo of a piece of ham gear or a circuit board isn't easy. You don't just whip out a point and shoot camera.

Not that you need a big, expensive camera . . . although the larger the negative, the better potential you'll have for getting a good shot. 35mm, even with a good macro lens, is marginal. It can be done, but the margin for error is small if you're going to enlarge the photo much. Even for photos for magazine covers I prefer a 6x9cm format. But let's say that all you've got is 35mm, so you're going to do what you can, hoping for the best.

If you need a black and white photograph you're going to shoot with black and white film. Even the best of color pictures get mushy when you try to reproduce them in black and white. Use the slowest film you can find, such as Ilford 50 or Panatomic-X. That will help you get the line grain you'll need for sharp enlargments.

If your camera has a macro lens you can get close enough to a small piece of equipment to fill the viewfinder. With the Nikon I like the 55mm macro best. Nice lens. But when you get close to the object your depth of focus narrows and parts an inch or so further away from the lens will be out of focus, even when you close your aparature down to its minimum . . . which is usually F-32. You need a much better depth of focus, and that means you'll have to stop down your lens much more. You want something more like F-256, which is about equivalent to a pinhole. So use a piece of card with a pinhole in it for your aparature.

This has a secondary benefit. In order to have the parts or a piece of equipment stand out clearly and be well lighted from all sides, you want to have a long exposure and wash in the light by moving it around during the exposure. With a half minute exposure you have time to wash out the shadows just fine. So set your camera on a very sturdy tripod, run a test roll of film to determine your best exposure, open your lens, wash the light, and you'll have superb professional photos that would cost you hundreds of dollars for a studio to make.

When I see the blurry junk some companies are using in their ads, and the awful photos that come with so many submitted articles, it's discouraging. I used to have a corner of a room set up just for equipment shots, with the lights, and my grandfather's old 1895 Pony Premo #5 5"x7" plate camera, which stopped down to F-256.

If you're going to shoot color for an ad or a possible *73* cover picture, use Kodachrome for fine grain. Cover shots should be vertically oriented with plenty of room on the top and left side for the logo and cover copy. We're always interested in creative hammy cover pictures.

Science and Life

One of the big problems with medical research is that it's being run by scien-

Continued on page 74

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Rob Bellville N1NTE, Northboro MA Lately, we've all been hearing about lawsuits, exam cheating, ridiculous behavior over the air, etc. Have we all forgotten that this is a hobby? If I'm going to spend my spare time (and money) doing something, you can bet I'm going to enjoy it! Why get bogged down bickering about trivial things that really don't amount to much in the grand scheme of things? Is it really so important to have a ham license that you have to cheat and pay hundreds of dollars for it? Does it really feel good to belittle people over the air?

Let's shape up *before* we lose out. Money is talking out there and frequencies all over the spectrum are being snatched up by commercial interests. Honestly, aren't there some very exciting things happening in communications? If you were in charge, who would you give the frequencies to—technology that improves the quality of life or quarrelsome, immature radio nuts? If we offered some real value to the public don't you think that the public would respond in kind?

We have been unable to be pioneers in developing new and improved ways to communicate (a fault, I believe, that is due partially to highly accelerated technology movements, again by the commercial sector). I feel that we should channel our efforts into being a cache of communicators ready and willing to fill a need where budget cuts have allowed particular public agencies to deteriorate. We should be masters at providing communications for the public's noncommercial demands. We get minimally involved in emergency communications, but that's not enough to be of real value. How about getting involved in crime watches? We have radio-equipped vehicles for patrolling. Ask your local organizations about how to get involved.

We have all these high-tech radios and all these operators waiting for action. Think of the skill level we could obtain if we were communicating with a purpose. Think of the creative process that would occur if we needed a new and improved way to communicate to accomplish a mission. Do you think we could regain our position as forerunners in communications?

As more and more new licensees are climbing on board for the enjoyment of communicating, rather than for the technical pleasures, this type of thinking becomes more valid. I enjoy amateur radio for both reasons, and do not look down on those who have singular interests. After all, isn't this hobby big enough to encourage specialists? We have accomplished CW ops, ATV pros, home-brew fanatics, and packet gurus, but why can't we have expert voice communicators? My experience has been that the newer Novice Code Techs are more enthusiastic about the hobby than anyone else. Why not allow the hobby to adapt and flourish in response to the growing ranks? People who enjoy something tend to learn more about it and tend to be pretty good at it too. Pretty soon these folks will be in the majority (and in control) and they'll be making the rules.

Athanasios Sellotis VE3TSK, from the 73 BBS After reading your editorials for a few years I thought you might be interested in a book I read while in university a few years back. The author was a radiologist by the name of Bjorn E. W. Nordenstr. He was able to cure inoperable lung cancers by the controlled use of DC current. His ideas seemed farfetched, but they worked. If you can find his book I would strongly recommend that you read it. His work has been all but ignored. If some high-priced institution should rediscover his work it might revolutionize the cancer treatment industry.

Can anyone help me find this book?. . . Wayne

Jon D. Merritt NØVTY, Burlington IA I have been getting *73* for quite a few years now. I like your format. It is a magazine, not a billboard for advertisers like another so-called magazine.

I have been into ham radio for only a couple of years now as a no-code Tech, and have just recently started working on code, instead of waiting for it to be eliminated from the exams. I work 2 meter packet mostly, and love it. And I have been experimenting with another digital mode idea, and with eliminating RFI from my TNC.

I do not agree with eliminating code. Ham operators should at the very least be tested for a general knowledge of code. Along with that, I have been hearing many stations on the ham bands not IDing their stations. In particular to my area, 2 meter ops are bringing up the autopatch on the local repeaters and not giving their ID. I have come in after their autopatch, and asked for an ID, and was ignored, and I made a point to be diplomatic about it, too. No request to use autopatch, no ID before or after! When I talked to a couple of other local operators, I was told that the overseer of the repeater should take care of the problem!

I don't believe in passing the buck, so I'm starting to make some noise around here on the local BBSs and with the local clubs. I don't want the amateur bands turned into more CB bands! I hear this on the HF bands too, and most of them sound like they have been in amateur radio for a while, too! We have these bands due to the grace of our government: we were not born with the rights to them! What a great way to show new amateurs how to operate. Why give the FCC another reason to sell off more of the radio spectrum?

We have rules and regulations to go by: Use them or lose them, along with your amateur privileges. Remember that word, privilege, not a right! I have tried to talk to amateurs about other subjects also, such as the code, the selling off of portions of the RF spectrum, and various political issues. Boy, you talk about dead band, or is it dead brain? And cold fusion. I am thrilled about it, but ask an operator around here about it and they think you are talking about cold cuts!

Olin K. McDaniel W4PFZ (Mac), Florence SC Wayne, I'm starting to worry. Recently I've found myself agreeing with you on too many issues!

What are the things on which we share common views? A major item is the slow but definite deterioration of our educational system (elementary and secondary schools) in this country. It's been over 20 years since my two children finished high school, yet I had an uneasy feeling that even they were being shortchanged. Now, 20 years later, there's no doubt in my mind. It's especially obvious when you read the writings of people coming out nowadays. Many are functional illiterates. They would have flunked every English course given when I was in high school. Even worse, they can't spell even the simplest words. I use GEnie as my BBS-type service, and see messages posted there from people who are presumably "computer whizzes." Yet, they spell "enemy" as "enema," "there" as "their" (and the reverse of that). That last error appeared repeatedly in messages from someone allegedly with a Ph.D. in a science doctrine. Even the documentation accompanying much of the high-priced computer software being released nowadays is filled with dozens of spelling and grammar errors. Without making a long list of examples, of which there are far too many, you should get my drift.

Although I'm now retired from DuPont, one of the most important things in my entire working career was not how skillful I was in my technical field, but how well I could communicate with others. This was especially true in written communications. These people coming out into the workplace today are at a terrible disadvantage with their sloppy writing and poor grammar, spelling, etc. Except for one thing, I guess—*most* of the people with whom they will compete for promotions, etc., are probably equally disadvantaged. Now for the frosting on the cake: Just this past week I read that the people who control this sort of thing are going to "readjust" the SAT scores, and artificially elevate almost all. That certainly seems to smack of endorsing mediocrity, doesn't it?

The reason I chose to write you this time was the letter from Irving Chidsey in the July 1994 issue. He seems to side with conventional scientists on issues like acid rain and the hole in the ozone layer, issues on which you have serious disagreements. I don't wish to take a position on acid rain—I have no basis for opinion. But on things like the hole in the ozone layer and global warming, I'm definitely a skeptic. In other words, I'm on your side. Much of this so-called science is overblown, hysterical and over-hyped because it's the politically correct thing. I agree with Dixie Lee Ray's position—there's simply not enough proof to justify the extravagant use of public funds. From what I've heard, even John Sununu, who holds a Ph.D. from MIT, is a skeptic about much of these so-called scientific conclusions. As far as global warming, there's almost as much compelling evidence that we are entering a period of global cooling. Obviously both positions cannot be correct; which is wrong? As for the ozone layer depletion, aren't they also at the same time screaming that fossil fuels usage is generating too much ozone? In my simple logic, I have trouble accepting that the ozone can't rise to the upper layer where it's claimed to be destroyed by the chloro-flouro carbons. Has this surplus near the surface vs. the shortage higher up been explained to your satisfaction?

Another reason for writing at this time is that you have aroused my interest in the cold fusion subject. I was especially intrigued by the bickering that went on a few years ago in the scientific community over this, with conventional scientists calling anyone supporting the possibility of it being real as charlatans, quacks, and not really scientists. I worried when my alma mater (Georgia Tech) became active in the early testing, that they would be smeared with the same tar brush. Again, this is a subject on which I have too few facts to have an opinion. (Clearly, the lack of facts doesn't deter people from having opinions, but I *try* to be objective when dealing with science.) Because of your recent editorial, I plan to follow up and become more knowledgeable on the subject. Then, perhaps I can be allowed an opinion.

Mac, as a pragmatist I hold tentative opinions built on doing my homework. Strong disagreements won't change my opinions unless they are backed up with relevant data that I might have missed.

You're right about our school system . . . you should see some of the letters I get! A mailing about K1MAN's broadcasts spelled "dedicated" as "deciated," "informantion," "injoy," "kick out off," "publishication," and "bare in mind." You get the picture.

Yes, cold fusion is alive and well, despite the elaborate burial by the hot fusion establishment. . . . Wayne

QRX . . .

Number 3 on your Feedback card

FCC Reorganizes

In August, FCC Chairman Reed Hundt announced a massive organizational overhaul at the Federal Communications Commission. New creations include: a Wireless Telecommunications Bureau, an International Bureau, an Office of Workplace Diversity, and a Competition Division in the Office of General Counsel.

Among other changes, the Office of Small Business Activities was moved out of the Office of Managing Director and will now report directly to the Commission. The FCC will now operate with six bureaus. Besides Wireless Telecommunications and International, the other four bureaus are the Common Carrier, Mass Media, Field Operations, and Cable Services.

The Private Radio Bureau was absorbed into the new Wireless Telecommunications Bureau, which will license and administer all personal communications service (PCS) licensing and other emerging technologies. The International Bureau will concentrate on global satellite and treaty-related issues. *TNX W5YI Report, Issue #16, August 15, 1994.*

Superconductivity Strides

A Japanese researcher has discovered a method for building superconducting wires of atomic dimensions, according to *Electronic Engineering Times*. Yositaka Yosida of Iwaki Meisei University's Department of Material Science stumbled on the discovery while experimenting with caging rare earth dicarbides in large buckminsterfullerene molecules. Yosida found that elongated carbon buckytubes containing tantalum carbide—a superconductor—are formed in electric arcs.

The result of these experiments is a superconducting wire with a protective coating of carbon. Superconductivity is an emerging technology in which electricity can travel through superconducting materials which exhibit zero resistance.

In a related development, a switched 32-channel filter bank designed to eliminate interference and jamming in microwave systems has passed its first major test by the U.S. Air Force, the first giant step toward the installation of HTS (high temperature superconducting) devices in the communications and radar systems of military aircraft. The filter bank is designed and manufactured by STI, Superconductor Technology, Inc.

The STI filter is seen as a big leap in technology. Today an aircraft can filter only one or two signals, which is inadequate in dense signal environments like those in the Gulf War. Tests of STI's optically-switched 32-channel filter bank found it successfully screened all but the target signal. Other potential beneficiaries of the technology would include cellular telephone networks. *TNX Electronic Engineering Times, August 15, 1994.*

UK to QRO

Power restrictions in Great Britain have been lifted on sections of the 1.8 and 50 MHz bands, according to the Radio Society of Great Britain. Antenna and ERP (effective radiated power) restrictions no longer apply on 50 MHz, either.

Holders of the amateur Class A license may transmit with 400 watts from 1.81 to 1.85 MHz, but the power limit from 1.85 to 2.0 MHz remains at 10 watts.

Holders of the full amateur Class A and B licenses may now run up to 400 watts between 50 and 51 MHz. The maximum permitted power between 51 and 52 MHz is still 100 watts. The ERP and antenna height restrictions have been removed from 50 to 52 MHz, allowing the use of any antenna including maritime mobile operation.

All UK amateurs are now required to notify their Radio Investigation Service office of unattended digital operation. The RSGB says this additional restriction was necessary following a number of problems with unattended operations. "The procedure is far less onerous than that required for a repeater or beacon on a hilltop site, and requires only the agreeing of suitable emergency close-down procedures," the RSGB said. *TNX Mohawk Amateur Radio Club, Inc. News, August, 1994; and the ARRL.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on CompuServe ppn 70310,775@compuserve.com; or at the *73* BBS at (603) 924-9343 (1200–19.2kb), 8 data bits, no parity, one-stop bit. News items that don't make it into *73* are often put in our other monthly publication, *Radio Fun*. You can also send news items by FAX at (603) 924-9327.

. . . or am I just getting older?

Youth Movement*—On the left you see the world's youngest ham, Connor McCann, carrying on a high-speed CW OSO. Well, he isn't really licensed yet, but his first utterance was "dah dah," according to his grandfather, Fred Doob AA8FO. On the right, one of the youngest hams in Columbus, Georgia, 12-year-old Josh Dally KE4GRJ, is seen working an eight-hour shift, assisting the Red Cross Disaster Services with emergency communications during some of the worst flooding in memory there. What a way to spend the Fourth of July! TNX Fred Doob AA8FQ and Joe Owen KO4RR. (Right photo by Miss Billi KD4CPB.)*

Number 4 on your Feedback card

Battle of the Monobanders

Iron Mike slugs it out in the QRP arena.

by Mike Bryce WB8VGE

In the past, if you wanted a QRP transceiver, you either had to use a Heathkit HW series rig, build your own, or reduce the output of your main rig. Whoa! Have things changed in the past few years. Now there's such an assortment of QRP transceivers on the market, it's actually hard to pick out the one best suited for your needs.

Since I've been using low power, I've seen a lot of QRP rigs pass through my shack. Most of them also made a stop at the service bench, too. Is there a one-and-only QRP rig? I decided to battle it out with all the single-band rigs I've either built, used or reviewed. Of course, you'll find there are some that I won't mention because I haven't had a chance to look at them.

As you can see, with all the different types and styles of QRP rigs on the market I had to set up some guidelines so we could compare one rig to other.

The Guidelines

In order for everyone to have a level playing field, I set up the following guidelines:

•Only monoband transceivers allowed.
•Transceivers only, no "transmitter-onlys."
•Either in kit form or assembled.
•Must be in current production.
•True QRP power.

With these guidelines in place, several rigs were automatically pushed from the list of candidates: the Ten-Tec Argo, because of its multiband capacity; the Index Lab transceiver, again because of its multiband capacity; and the Ramsey transmitter/receiver kits. The Ten-Tec Argosy/Argonaut/Argonaut II and the Heath HW series, along with the Yaesu FT-7, were out of the running because they are either no longer in production or are multiband rigs. Rigs by Radio Kit do not appear, either—only because I've not yet used or built any of their current lineup.

The Battle Begins

Each of the rigs I've used, or have built. Each of them has all the necessary requirements to be in the battle of the monobanders. I'll describe each of the warriors as well as any comments I noted during assembly.

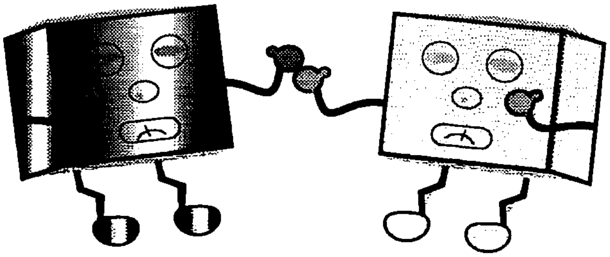
The A & A Engineering Transceiver

Based on the popular *QST* article by Gary Breed, this monoband transceiver comes in kit form. It was originally designed for 20 meters, but you can modify the tuned circuits to cover either the 40 or 30 meter bands. As with all the other rigs in the battle, this is a CW-only transceiver.

What makes this rig special is the high-tech circuit. Instead of the usual NE602s, Gary used a multifunction IC, a receiver on a chip if you will. The rig used a super heterodyne receiver; it's not direct conversion.

The VFO is controlled by a pot instead of a variable capacitor, which makes assembly much easier. A fine-tune control allows small adjustments of your operating frequency. However, you really don't know where in the band you're at with the tuning scale. There's no RIT on this rig.

This is one of the few kits that I have assembled that went together quickly and with few problems. The two PC boards are of high quality, as is the punched, silk-screened and painted cabinet. This rig is the only one to feature an S-meter that doubles as an RF output meter. It's a nice feature to have.



The manual is an assortment of pages, mostly copies from the *QST* article. Oversized PC board parts placement really helps assemble the kit. You'll need better than junk box test equipment to adjust and align the rig. Alignment and repair are provided if you want. A & A Engineering has good repair service and customer help.

A relay controls the T/R function of the rig. A robust 4+ watts proved more than enough to work the world. The internal speaker provides plenty of audio and there is even a headphone jack, too.

The Tejas Backpacker

This guy uses an improved direct conversion receiver based on the work by W7EL.

What makes the Backpacker stand out from the rest of the direct conversion rigs is the heterodyne mixing used by the VFO. Running the VFO at a much lower frequency, then mixing it with a second oscillator, improves stability. The Backpacker can be made to operate on several different bands by changing out the necessary frequency determining components. Of course, the Backpacker will only work on one band at a time. RIT is available to allow you to work those HW-7s off of your frequency.

I found the Backpacker to be quite lively in the reception of weak signals. If my old Drake R4B could hear the station, the Backpacker would, too. The QSK system has lighting-fast electronic switching. The Backpacker will produce a bit over 2 watts at 13.8 volts.

I was impressed with the keying of the transmitter. It sounds good on the air, without the usual chirps and clicks of some rigs. The Backpacker comes in a very impressive aluminum cabinet. Even the silk-screened lettering is epoxied so it won't rub off. It's a very stout little rig. The Backpacker now comes only in kit form.

On the downside, the Backpacker does not come with a speaker—an external speaker or headphones must be used. The dial readout is mostly linear, but you'll have a hard time locating a specific frequency. There are several PC boards inside the Backpacker, and a lot of interconnecting wires between the boards. It's easy for the beginner to mess up one wire connection. The manual is good, but has some rough spots. Repair service is available.

The MFJ QRP 9040

Who would think MFJ would be selling a QRP rig? Well, I bet they're doing a brisk business.

The MFJ rig is based on a very simple, well-engineered circuit. There are plenty of NE602s on the single PC board. Depending on which MFJ rig you have, they will cover 40, 30 and 20 meters, CW only.

The MFJ is built around a single PC board. This board is roughly the size of the cabinet. Other than one wire leading to the SO-239 antenna connector, there is no internal wiring. All the external controls are mounted to the PC board.

Frequency control of the MFJ is by the usual VFO using a vernier-driven capacitor.

The dial is again mostly linear, and you'll have a fairly good idea of where you're at on the band. There is no internal calibrator. The VFO stability is very good under shack conditions. The main VFO knob is large enough to twist without the feeling you'll break something inside. The center detent RIT is great to have on this little rig.

The transmitter will develop a whopping 5+ watts. Keying is very good using semi-break-in T/R control. The MFJ would be an easy rig to fix. Most of the parts are standard *off-the-shelf* pieces.

The first batch of these rigs suffered from low audio output. That problem is now corrected in current production units. The MFJ comes factory assembled only. Also, first production runs did not hear as well as they could have. The current units now have a post-IF amplifier to really bring out the weak signals.

You can add on an audio CW filter as well as a Curtis-based keyer. They both plug into the main PC board; there's no need to solder in anything. You can easily upgrade both options at once or add them on as you need. I recommend the CW filter.

The manual is very complete. There are schematics, block diagrams, and several pages of helpful hints. There's an 800 number for help. The MFJ unit comes with a stout warranty.

The S & S Engineering ARK-40

A newcomer in the world of QRP transceivers, the ARK-40, is the only rig on the market for under $300 that sports synthesized frequency control.

The ARK-40 comes in kit form, and there are a lot of pieces in an ARK-40. It's a kit that will require some experience in kit building. The ARK-40 is complex. It has two main boards, and both have plated-through holes and are double-sided.

Building the kit took me about 16 hours. One feature that speeds the assembly of the ARK-40 is the many prewound coils and transformers. Also, many of the parts come in their own package so you don't have to wade through a pile of resistors just to find the 10k resistors.

The ARK-40 has full QSK keying. However, the keying relay is a bit loud. You get a full 5 watts of RF to your antenna. The ARK series is available for 40, 30, and 20 meters. You can install an internal Curtis-based keyer inside the ARK-40.

There's plenty of audio coming from this rig. It sounds really good, partly because of the front-firing speaker. An excellent audio filter is also included in the base price of the ARK-40.

The instruction manual is excellent. There's a lot of information on how the rig works, troubleshooting, and even the world's shortest burp on antennas. Factory service and repair is available if you can't get your kit working. Service from S & S is quick, friendly and timely.

The tuning method is a bit different from what most hams are used to. The use of push-buttons to set the operating frequency is both a first and a minus. I'll explain. It's great for setting the frequency to exactly where you want to be. If you have a schedule at 7.0323, you can set the frequency precisely. On the other hand, band tuning is a bit slower than just turning a knob. It's not a contest rig.

I'm impressed with the construction of the ARK series. You could use the ARK-40 as a wheel chuck for your camper, and then operate Field Day the next weekend. It's military-tough in its extruded aluminum case.

The ARK-40 is the most expensive kit of the group.

The S & S Engineering ARK-4

The ARK-4 is an ARK-40 after a trip to Weight Watchers. It's a slimmer, leaner version of the ARK-40. Instead of two PC boards, only one is required for the ARK-4. The ARK-4 comes in a vinyl-covered steel case and not the extruded aluminum style of its bigger brother.

You can build the ARK-4 in steps, checking out each stage as you go. Options such

as a CW filter, RIT, and a fine-tune control make for a very well-designed QRP rig. The ARK-4 is only available for the 40 meter band.

Full QSK, again with a rather loud relay, controls 5 watts of RF. Frequency control is also by push-buttons, but with a fine-tune control for small changes in frequency. You have the same "set it and be there" frequency control as the ARK-40.

And, like the ARK-40, the manual for the ARK-4 is great. There are plenty of pointers to help out the new builder.

The OHR Rigs

This is the one exception to my guidelines—I've never assembled any of the OHR rigs. But, I did include them in this battle simply because so many people have used them. But, this will be only a brief look at the many OHR rigs. I have operated some of the OHR rigs during Field Day.

There are several models of OHR rigs. Most are based on NE602 designs. And, like most of the other guys, you can build the OHR rig for the band of your choice.

The OHR rigs are big. They're not something I would put in a backpack. Yes, there are some smaller OHR rigs, such as the Sprint, but overall they're large. In some cases this is a plus! Larger PC boards are easier for the new builder to work on.

Depending on the model, direct conversion and superhet receivers are used. All the OHR rigs meet the QRP power level for contests.

The manuals for the OHR are very complete. There is a repair service available and phone help as well.

The Howe Transceiver

This kit was the hardest to assemble. There's a lot of drilling and custom metal work to be done on the huge aluminum chassis. A direct conversion receiver, the Howe transceiver works quite well when assembled. It's not a first-time kit, however, as each section of the rig contains its own PC board. All of the boards are then wired together to form a complete transceiver.

The receiver will not drive a speaker without microphonics developing. It's a headphones-only rig. The transmitter produces a solid 3 watts of output.

The lack of any type of QSK is a real low point in the Howe transceiver. You must manually switch from receive to transmit and back again. The assembly manual is a bit disorganized. It needs to be updated.

What Mikes Likes . . .

The winner of this battle in the kit class goes to the ARK-40 by S & S Engineering. It's solid, and a great performer. The people at S & S stand by their product with both service and assembly help. I especially like the ability to know exactly where I'm at on the band. Yes, it is expensive, but you get a lot for your money.

The runner up is the A & A Engineering rig by Gary Breed. I liked this kit because it went together so well. However, the lack of a RIT control hurts this fine QRP transceiver.

Next up, in third place, are the many rigs from OHR. Simple in design, and in use, they're fine rigs for the novice builder. Large easy access to the PC board makes building them a pleasure.

Factory-Assembled

My number one choice for this category goes to MFJ. Their 90 series of QRP transceivers put a lot of fun back into ham radio without a lot of money leaving your pocket. (Model 9015 is featured on the cover.) The street price of the MFJ rigs is running about $150. You can have an MFJ QRP transceiver on the air less than five minutes after you open the box. The MFJ-9020 is an ideal way of trying out QRP.

That's my opinion. Remember, my choices reflect what I like in a radio. Your likes may be a lot different from mine. All of these rigs are decent, so don't forget to ask around, and make a purchase that's just right for you! 73

The Traveler

A sweet home-brew receiver for 80!

by Paul G. Daulton K5WMS

Here is a simple, high-performance, 80 meter SSB receiver designed around the Motorola MC3335P IC chip. It is a true single-sideband superhetrodyne, with a three-pole crystal filter and crystal-controlled BFO, using inexpensive microprocessor crystals. The cost is comparable—no more than $8 to $10 over the cost of any of the popular direct conversion receivers using the NE602/LM386 combinations. Arrangements have been made with Dan's Small Parts Co. (1935 South 3rd West #1, Missoula MT 59801; telephone/fax: 406-543-2871) to offer a kit of parts (including the circuit board, from FAR Circuits, all board-mounted components, volume control, switch, and a 4-to-40 pF air variable with built-in 8/1 reduction drive) for $39.95 plus $3.75 S&H. If you decide to go it alone, the PC board is available from FAR Circuits (18N640 Field Court, Dundee IL 60118, $4.75 plus $1.50 S&H) and the remainder of the components from Mouser Electronics and DC Electronics (see the Parts List for addresses).

I think this design is suitable for a first-time project. Clubs and ham classes might consider this receiver for a group project for newcomers. Today there is a lack of entry-level equipment for the new hams to use to gain technical and operating experience. When I got interested in ham radio in the mid-1950s I, like others, came into the hobby through shortwave listening. Most of the hams at that time were still using AM, which was easily received on any shortwave receiver, even the home entertainment variety. Today few people come into our hobby except by exposure to CB or VHF repeater operation heard on their scanners. I think they miss a lot in this process of not being exposed to the 80 through 10 meter bands, just listening and learning. The newcomer would only need to be taught component recognition and soldering skills to be able to assemble this receiver. Only two adjustments need to be made (for alignment), and these can be made listening to signals off the air without any test equipment, if necessary.

Circuit Description

See Figure 3. The MC3335p IC is a 20-pin dip chip designed as a complete FM receiver minus the audio amp. It features two oscillator mixer combinations, limiter, quadrature detector, squelch and received signal strength indicator circuits.

"Clubs and ham classes might consider this receiver for a group project for newcomers."

The MC3335p is an application engineer's dream. Power connections are made to pin 5 (+) and pin 15 (-). Voltage is routed to each stage internally, and all biasing and regulator circuits are internal. Only two external connections need to be made to each stage. The first and second mixers have gains of 18 and 22 dB respectively. Gain of these mixers is independent of the supply voltages. In its most common application a VHF FM signal of say 49 MHz would beat against the first oscillator (10.7 MHz higher or lower) and the 10.7 MHz IF signal from the first mixer would exit the chip at pin 17 and pass through a ceramic filter. After passing the ceramic filter, the 10.7 signal would re-enter the chip at pin 16 and go to the second mixer where the signal would beat against the 10.245 MHz crystal and be converted to 455 kHz. The 455 kHz from the second mixer exits the chip at pin 4, passes through a second filter of 455 kHz and returns to the chip at pin 7 for processing through the limiter and FM detector circuits. So much for how the MC3335P works as an FM receiver.

To use the MC3335P to receive 80 meter single sideband I used the following scheme: The 4.0 MHz lower sideband signal enters the chip at pins 1 and 20 from T2, the antenna coil. The first oscillator operates at approximately 9.0 MHz, controlled by T1 and the varactor diode. This 9.0 MHz signal beats with the 4.0 MHz signal and produces a 5.0 MHz signal in the first mixer. This 5 MHz signal exits

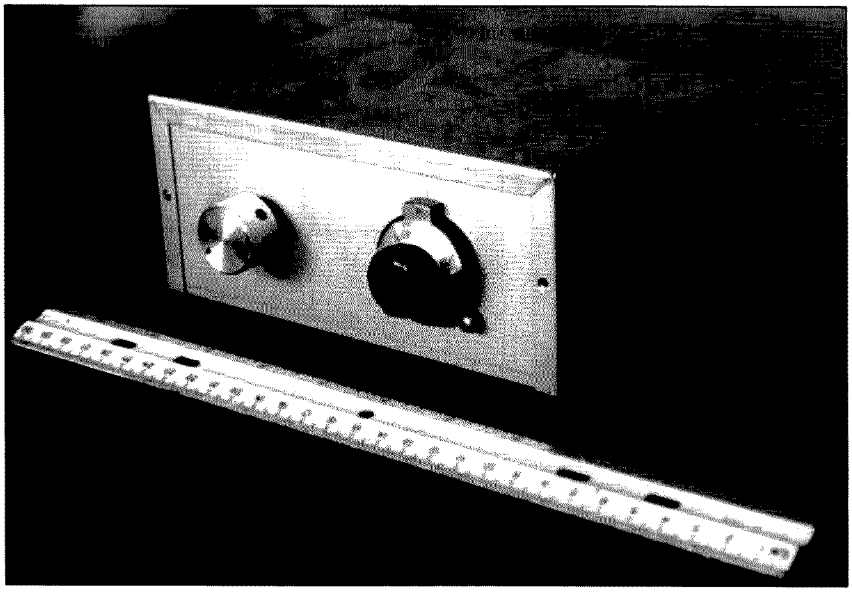


Photo A. Front view of The Traveler. (Photo by NRG Photo, Jacksonville, Arkansas.)

the chip at pin 17, passes through the 5 MHz bandpass filter formed by Y1, Y2 and Y3, and re-enters the chip at pin 16 to the second mixer. The second oscillator, crystal controlled at 5 MHz, beats with the SSB or CW signal to form an audio frequency that goes to the LM386 audio amp. Much of this is an over-simplification, and the frequencies have been rounded off just to get you familiar with the processes involved. I will be more specific later on.

The real heart of this receiver is the bandpass filter formed by Y1, Y2, and Y3 (see Figure 4). Wes Hayward W7ZOI described a simple three-pole filter in his July 1987 *QST* article, "Designing and Building Simple Crystal Filters." I decided to try a variation of his filter using 5.185 MHz crystals instead of 4.0 MHz. The values shown worked so well from the first prototype that I have not done any further experimentation. The filter bandwidth is inversely proportional to the value of C and directly proportional to the termination impedance R. Increasing the value of C would narrow the filter but I would not recommend doing this. The 3 kHz selectivity of this filter is adequate for a simple receiver of this sort. Narrowing the bandpass would require moving the BFO frequency. Also, the pin spacing on the chip, 0.1", limits the amount of attenuation in the filter by leakage around the filter. The filter is terminated by the output and input of the first and second mixers. This termination impedance is close to the ideal value so no further impedance matching is required.

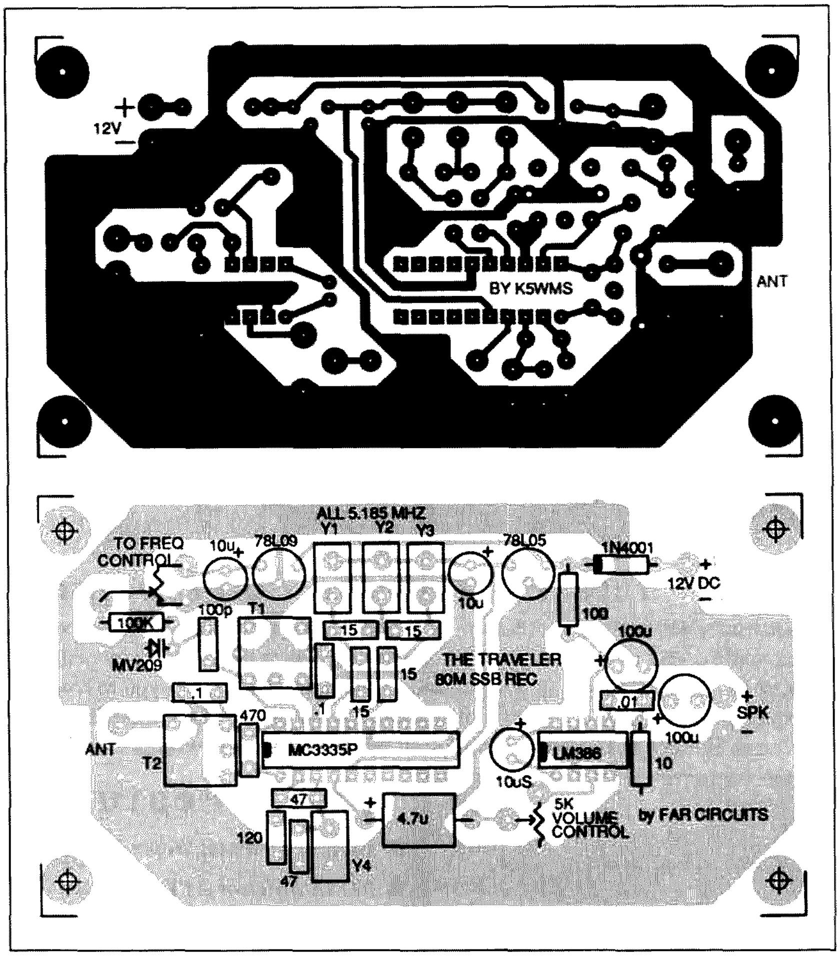


Figure 1. PC board layout and parts placement.

Selection of the IF and VFO Frequencies

To correctly receive an SSB signal it is necessary to place the carrier frequency on the edge of the filter bandpass.

See Figure 5. The second oscillator in the MC3335p is a common base circuit. With a simple oscillator circuit like that on the MC3335P, all you can do is lower the frequency by padding the crystal with an external capacitor. I selected the 47 pF and the 120 pF capacitors in the divider circuit and the 47 pF across the BFO crystal Y4 to produce the correct BFO frequency. The purist might think the 47 pF capacitor across Y4 should be variable, but that would add another adjustment the beginner might not have the equipment and skills to accomplish. Besides, I have built six of these receivers using randomly-selected crystals and 10% NPO disk ceramics, with no trouble in the BFO circuit.

The filter and BFO combination I described are for USB, as the carrier frequency is on the lower side of the filter. To receive LSB 80 meter signals I chose a VFO frequency above the IF frequency (9.0 MHz). Sideband reversal takes place when the mixer products are subtractive rather than additive. For example, with a carrier frequency of 5.185 kHz, the upper sideband limit, assuming a 2 kHz band width, is 5.187 kHz:

9.185 MHz (VFO freq)
- 5.185 MHz (carrier freq)
4.0 MHz (new carrier freq)

9.185 MHz (VFO freq)
- 5.187 MHz (USB limit)
3.998 MHz (LSB limit)

IF the antenna coil were tuned to 14 MHz instead of 4.0 MHz the unit would receive 14 MHz USB.

9.185 MHz (VFO freq)
+ 5.185 MHz (carrier freq)
14.370 MHz (new carrier freq)

9.185 MHz (VFO freq)
+5.187 MHz (USB limit)
14.372 MHz (USB limit)

I considered making this receiver a two-band unit by switching the antenna coil, or a three-band unit (80-40-20) by switching the VFO to 12 MHz for 40 meters, but I discarded that idea as too complex. I plan to add other bands with crystal-controlled converters.

Audio

The LM386 provides more than enough audio to drive a 4" speaker to comfortable listening level. With a good dipole antenna connected to my Traveler the audio gain is limited to a half rotation or less before the audio goes into distortion. I plan to use my receiver in my motor home (hence the name Traveler) with less than ideal antennas, so I wanted as much audio gain as possible. If you find this lack of range annoying, there are several ways you can limit the audio gain: You can change the 10 µF cap across pins 1 and 8 of the LM386 to a 4.7 µF, 2.2 µF, or 1.0 µF until you are happy with the range of the audio gain, or add a 4.7k ohm resistor in series with the volume control, or add a 500 ohm attenuator pot across the antenna terminal for an RF gain control. See Figure 6. I use a plastic case CB extension speaker with my receiver. These extension speakers are sold under the names of Barjan, President, Diesel and other trademarks at most truck stops; the price runs from $6 to $15.

Lack of AVC is the only limitation to

Continued on page 18

The Traveler

Continued from page 16

this design. Since there is no access to the mixer stages the only way to control the gain is at the audio level. Steve Szabo N1AYO described an audio level controller in the February 1993 issue of *Electronics Now*. This audio leveler uses an NE577 compander in combination with an LM386 audio chip. I have built one of these and installed it in one of the Traveler prototypes and I am very happy with the performance. C&S Electronics, P.O. Box 2142, Norwalk CT 06852-2142 (phone or fax 203-866-3208) sells full and partial kits for this audio leveler.

Coils

Builders who have written me about "The Explorer" (*73*, August 1992) have expressed a preference for prefabricated and adjustable coils. I designed the Traveler to use Mouser 42f126, 10.7 MHz IF transformers for the antenna and VFO coils. I have had good luck with these. Please do not substitute another 10.7 MHz IF can—you might wind up with another turns ratio or impedance and performance would suffer.

VFO Tuning

I chose to use a varicap diode and potentiometer for tuning because of cost and availability of a proper air variable. An alternate air variable tuning system is shown in Figure 2b. Using the values shown and a carbon 5k ohm potentiometer with 270 degrees of rotation, I wound up with 900 to 1000 kHz of tuning range. Since I used a vernier dial with only 180 degrees of rotation, the tuning range is limited, mechanically, to about 600 kHz. If you choose a dial drive that has more freedom of rotation, or a 10-turn pot with a concentric dial, and you wish to expand the 600 kHz tuning range to fill the whole extension of the dial mechanism, add a 5k ohm pot between the 5k ohm tuning pot and ground.

First set the tuning pot to the high limit. You should have about 9 volts at the wiper. Next turn the adjustment slug of T1 until a 4.0 MHz signal is zero beat.

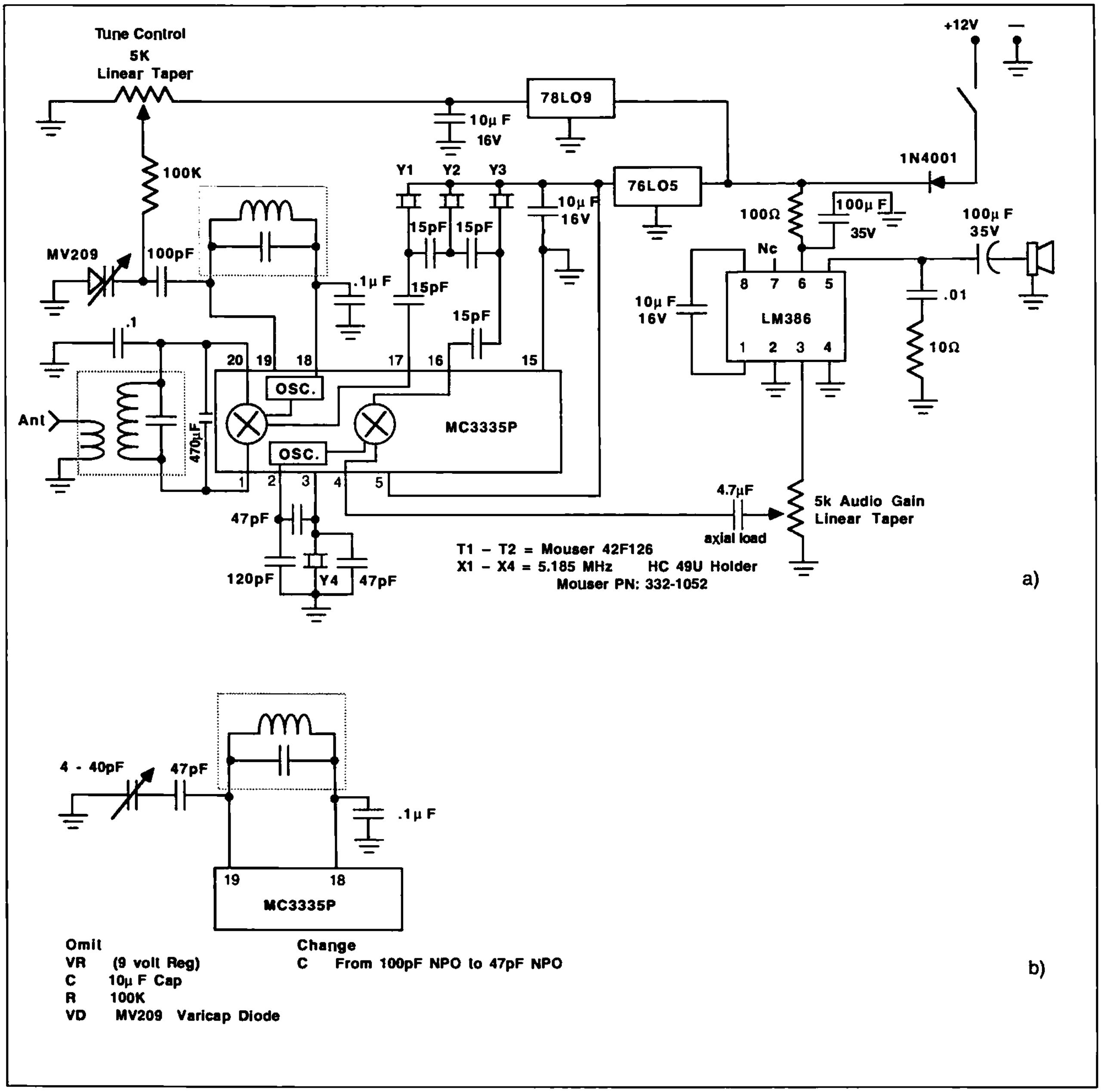


Figure 2. (a) Schematic diagram for The Traveler; (b) alternate air-variable tuning method.

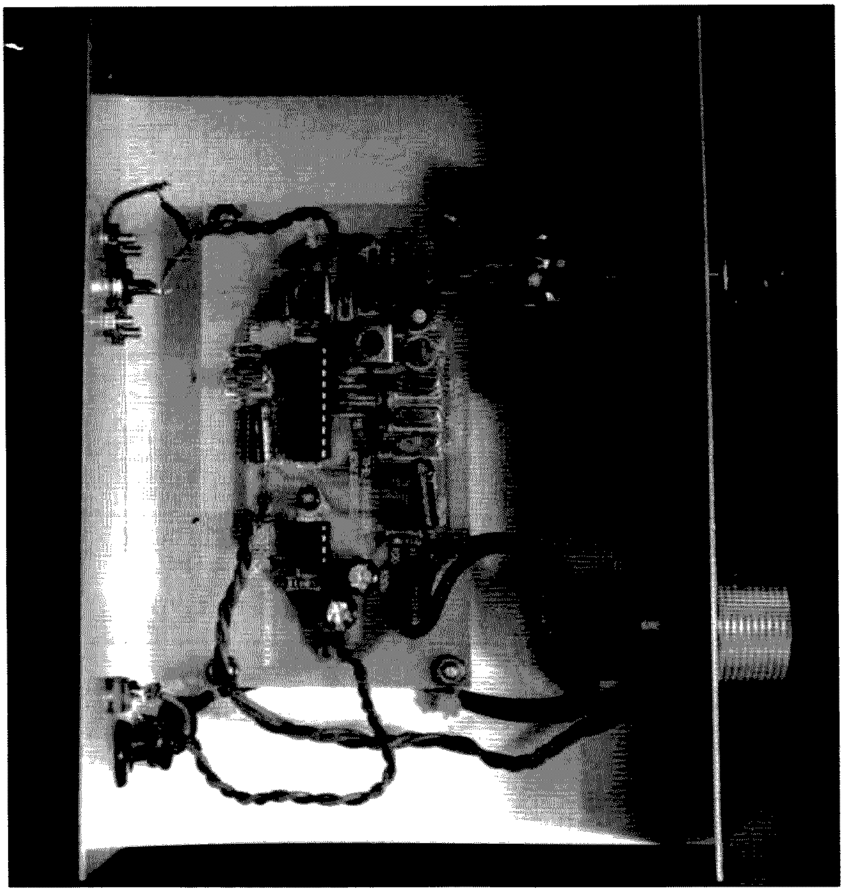


Photo B. Under the hood of The Traveler. (Photo by NRG Photo, Jacksonville, Arkansas.)

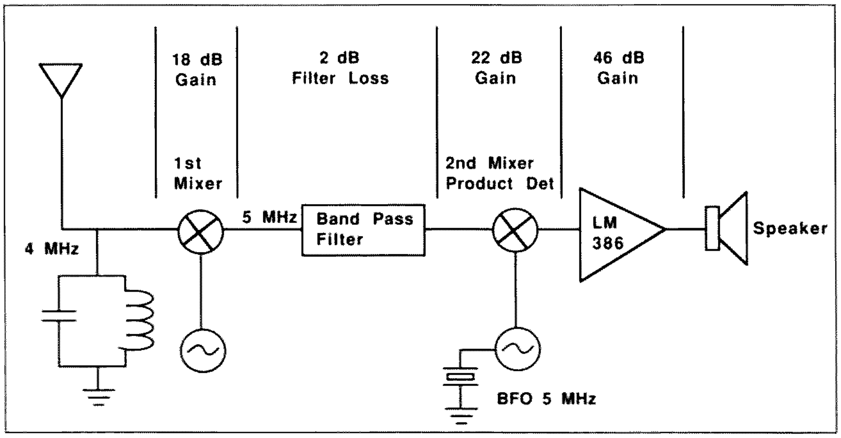


Figure 3. Block diagram for The Traveler.

Now set the tuning pot at the lower limit and adjust the scaling pot until the unit receives 3.5 MHz. Now measure the scaling pot with an ohmmeter. Then remove the scaling pot and replace it with a fixed resistor of the nearest standard value to what you measured.

Construction

I have used both a plastic cabinet and LMB minibox to house The Traveler. The 8" x 5.5" x 4" plastic cabinet is sold by DC Electronics (stock #16144; $13.64). It features removable panels of ABS plastic, easily drilled with ordinary woodworking bits. The 7" x 5" x 3" metal utility box by LMB (Mouser stock #537-tf-782; $8.10) is a bit cheaper and serves just as well. I do not recommend mounting the speaker in the cabinet as this circuit is sensitive to magnetic fields. I noticed this while running a trial fit on a speaker, the receiver would shift frequency when the magnet was brought within two inches of the MC3335p chip. Use an external speaker.

Begin by running a trial assembly on the blank board in the cabinet you intend to use. With the dial drive, tuning pot, volume control/switch, antenna connector, and speaker connector, making sure you do not have any interference between the components. Mark, drill, paint and label your cabinet, then set it aside.

Begin assembly of the circuit board by installing sockets for the ICs. After soldering the connections to the ICs, inspect each pad with a magnifying glass, checking for proper solder joints. Then check adjacent pins for shorts, using an ohmmeter set on low scale. This is the most critical part of the assembly. A short, even on the unused pins, could damage the chips. Now sort out the capacitors in like values and install these in groups of three or four. Note the + and - symbols on the electrolytic caps. A + sign is printed of the component side of the board to help you with correct orientation of the electrolytics. Locate and install the three 1/4-watt resistors. The crystals Y1-Y4 may be installed next. Install the 1n4001 diode, matching the end with the white band (cathode end) to the likeness on the circuit board. Install the MV209 varicap diode. Note the correct orientation of this diode from the drawings. Install the 5-and 9-volt regulators. Refer to the X-ray view drawing, the schematic, and part drawings for correct orientation of the regulators. I specified the small plastic case 78L05 and 78L09 regulators but you can use the larger tab mounted 7805 and 7809 regulators with no problem.

I used 22 ga. solid conductor hook-up wire for all connections to the circuit board except the 12V power leads; for that I used 18 ga. stranded. The larger stranded wire was selected for mechanical strength and flexibility rather than current capacity. Use different-colored wires going to the speaker, the controls, and antenna jacks: red for plus, black for ground, and green for the wiper on the controls. Twist the leads together five to six turns per inch to eliminate hum pickup.

With the board assembled, there are a couple of checks to make before installing the ICs and wiring the board to the cabinet. Temporarily connect 12 volts to the board. Check the 5- and 9-volt regulators. There should be +5 volts at pin 5 of IC2 and +9 volts at the top of the tune control (red wire). Feel the components; nothing should be warm to the touch. If the board passes these tests you are ready to install it in the cabinet, make the final connections, and install the ICs.

Alignment

Now that your receiver is completed, alignment is very simple. Set the tuning control to its upper limit with the set screw on the vernier dial loose. Turn the vernier dial to 100 and then tighten the

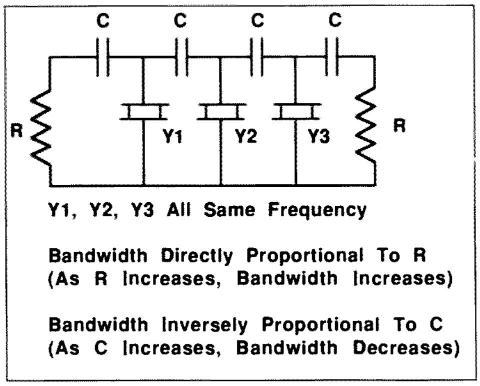


Figure 4. The filter described by W7ZOI.

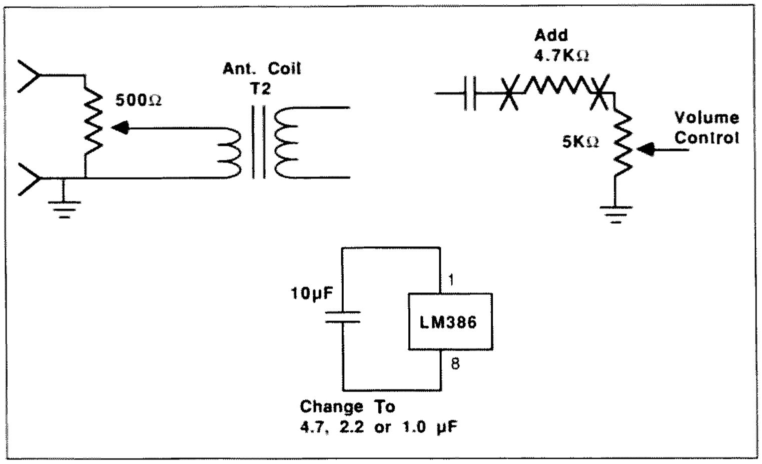


Figure 6. Ways to limit audio gain.

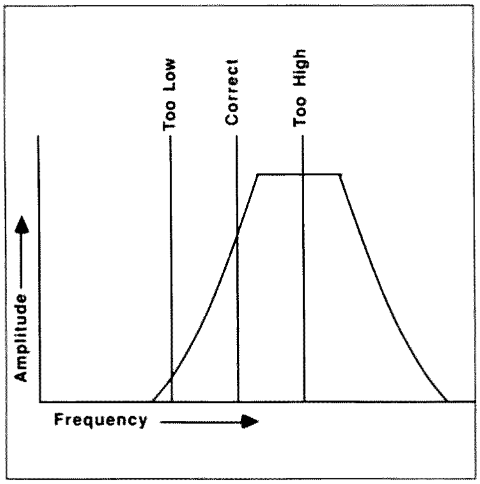


Figure 5. BFO frequency placement.

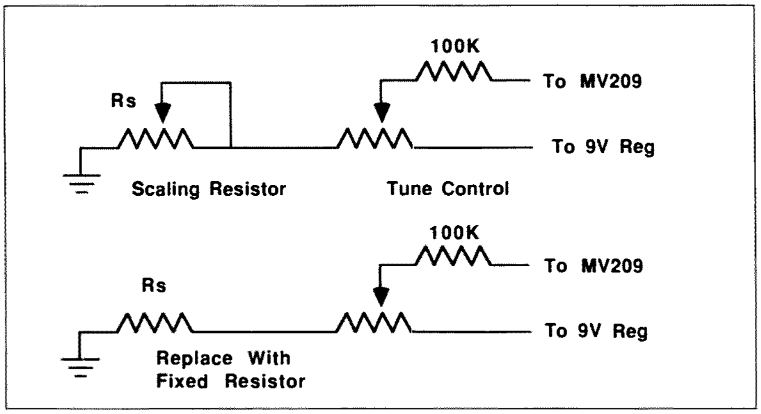


Figure 7. Band-spreading the VFO.

If you do not have a signal source like a grid-dip oscillator, signal generator, or ham transmitter, you can listen to the phone signals up at the top of the 80 meter band and get close. The adjustment of T2, the antenna coil, is very broad so do not expect much of a peak. This adjustment is best made listening to a weak signal. Now you are ready to sit back and enjoy your receiver.

Performance

My Traveler has very good sensitivity. Signals of less than one microvolt are readable. Selectivity is about 2.5 to 3 kHz. Tune downward across a steady carrier and you will hear a signal come into the passband of the receiver at a beat note of 2 to 3 kHz. The signal will rise in strength until you pass the zero beat where it will drop out and disappear or be very faint. That's single sideband selectivity. With a direct conversion receiver you would hear the signal on both sides of zero beat. Short-term stability is good; however, the varactor is more sensitive to temperature changes than an air variable would be. I use an 80 meter dipole at my home station. For portable or mobile operation I use an MFJ antenna tuner for short longwire antennas and whips.

Special thanks go to Fred Reimers at Far Circuits for the excellent design work on the printed circuit board.

I hope you find this project fun and educational. I've had 35 years of enjoyment from amateur radio and it's time I put something back into the hobby!

A word in closing about the kit offered by Dan's Small Parts: We decided to go with the alternate air variable tuning system partially because of cost, and partially for performance. The air variable Dan uses in these kits has a built-in reduction drive, eliminating the need for an expensive panel-mount drive. The 9-volt regulator and associated components are also

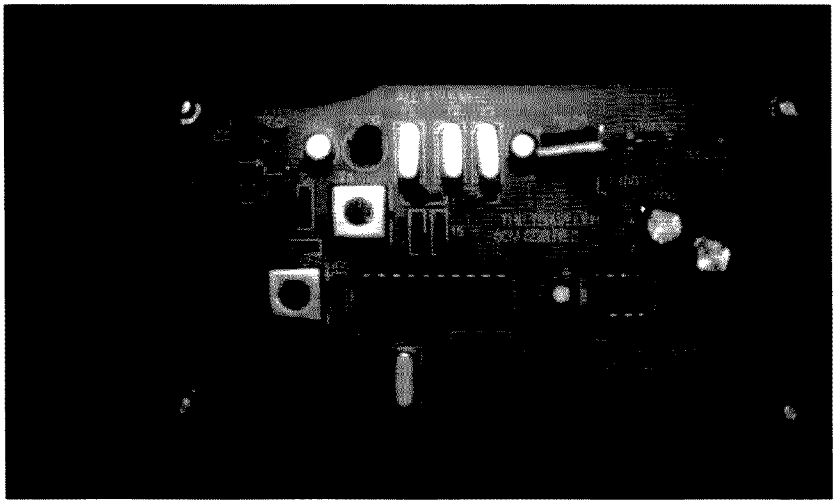


Photo C. The Traveller's circuit board (photo by K5WMS).

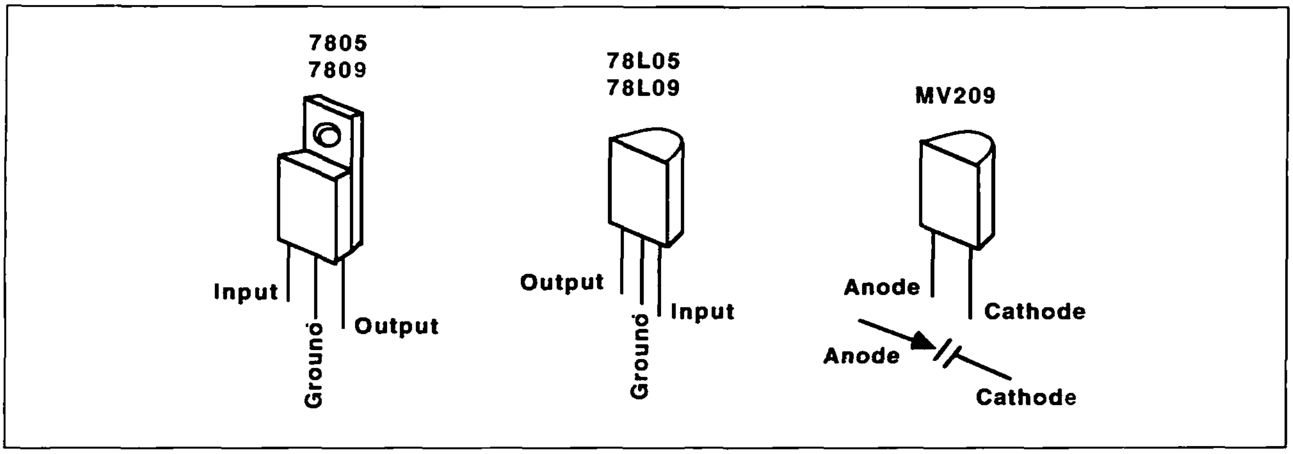


Figure 8. Part drawings for varicap and voltage regulators.

Parts List

Item	Quantity	Description	Source
IC1	1	LM386	DC
IC2	1	MC3335P	DC
T1,T2		Mouser 46F126 10.7 MHz IF trans.	DC, Mouser
IC3	1	78LO5 5-volt reg.	DC
IC4	1	78LO9 9-volt reg.	DC
D1	1	IN4001 diode	RS
D2	1	MV209 40 pF varicap	DC
C1,2	2	0.1 µF mono or disk	DC, RS
C3-6	4	15 pF NPO disk, ceramic	Mouser 21FL015
C7,8	2	47 pF NPO disk	Mouser 140 CD50NC-097IL
C9	1	120 pF NPO disk	Mouser 140 CD50N6-121k
C10	1	470 pF NPO disk	RS
C11	1	4.7 µF axial lead	RS
C12-14	3	10 µF 16V radial lead Electrolytic cap	RS
C15,16	2	100 µF 35V radial lead electrolytic cap	RS
C17	1	0.01 disc ceramic cap	RS
C18	1	100 pF NPO disc ceramic	RS
R1,2	2	5k ohm linear taper pot	RS
S1	1	Switch mounted on audio chain	RS
R3	1	100 ohm 1/4-watt res	RS
R4	1	10 ohm 1/4-watt res	RS
R5	1	100k 1/4-watt res	RS
Y1-Y4	4	5.185 MHz crystal HC49U holder	Mouser 332-1052

Builder's option: 1-1/2" or 2" vernier drive; cabinet.

*Sources:

Radio Shack

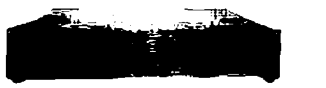
DC Electronics
P.O. Box 3203
Scottsdale AZ 85271-3203
(800) 467-7736

Mouser Electronics
2401 Hwy. 287 North
Mansfield TX 76063
(800) 992-9943

A parts kit (including the circuit board, from FAR Circuits, all board-mounted components, volume control, switch, and a 4 to 40 pF air variable with built-in 8/1 reduction drive) is available from Dan's Small Parts Co., 1935 South 3rd West #1, Missoula MT 59801, (406) 543-2871, for $39.95 plus $3.75 S&H.

A drilled and etched PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4.75 plus $1.50 S&H.

eliminated, further reducing the cost. And, as a bonus, the receiver can be operated from a 9-volt battery as well as a 12-volt DC power supply. If you build one of these receivers please drop me a postcard and let me know how it works.



73 Review

Number 6 on your Feedback card

by Michael Bryce WB8VGE

The A&A Engineering 20 Meter QRP Rig

Easy to build and simple to operate.

A&A Engineering
2521 W. La Palma #K
Anaheim CA 92801
Telephone: (714) 952-2114;
FAX (714) 952-3280
Price Class: $159.95

If you've been looking for a small monoband QRP transceiver, the current market has quite a bit to offer. Your search may come to an end if you take a closer look at A&A Engineering's rig.

This CW-only QRP transmitter was designed by Gary Breed K9AY and appeared in the December 1990 and January 1991 issues of *QST*. Gary designed the rig to be easy to duplicate for the average ham. For this review, A&A Engineering supplied the 20 meter version; 40 and 30 meters versions are also available.

It's Different

The circuit is different from what we have been seeing in other QRP rigs. Instead of several NE602s doing the work, a single multifunction IC does all the magic. The Motorola MC3362 is a dual-conversion superhet VHF FM receiver on one chip. Other than an audio power amplifier, all you need is a handful of parts to make a receiver. That's exactly what Gary did.

The rig is tuned by a varactor controlled by the voltage coming from the main tuning control. Two tuning pots are used. One is the main tuning control, which covers about 50 kHz, and the other is a fine-tune control. It works just like the bandspread control used in the older receivers. The fine-tune control allows +/-2 kHz of tuning. There is no vernier drive to either pot, so tuning is a bit fast. There is no RIT control either. The transmitter provides an automatic 800 Hz offset of frequency during transmit.

Four handpicked crystals make up the IF filter for the A&A Engineering rig. These crystals provide the 400 Hz selectivity so useful in CW work. But, for my taste, it's a bit too narrow.

Since the MC3362 requires an external audio amplifier, Gary added some bandpass filtering and a smooth-working AGC to control the LM386 audio power amplifier. An LM324 provides excellent bandpass filtering. In addition, this filter avoids the ringing that so often comes with a narrow-audio filter. Two sections of the LM324 provide a low-pass of 1200 Hz cutoff and the other section provides a high-pass cutoff of 600 Hz.

The audio-derived AGC is controlled by an MC3340P. This audio-gain-control chip provides a smooth AGC without the popping that sometimes occurs with audio-derived AGC. The attack time and delay seem just about right for me and the way I like to listen to CW. The AGC is fast attack, slow release.

The AGC circuit also drives an S-meter. This A&A Engineering rig is the only QRP monobander that I know of with an S-meter. It's a nice way to tell how strong one signal is compared to another; it's not a laboratory-calibrated meter by any means. The S-meter does double duty, too: You can use it to adjust the front end of the receiver during tuneup.

A conventional audio power amplifier, using the LM386, rounds out the receiver. It produces enough volume for a small room. The LM386 is not known for rattling windows. The A&A Engineering rig has one of the largest speakers of any of the monobanders I've reviewed. It won't blow you out of the room with shear volume, but it sounds really good. A front-mounted 1/8" headphone jack automatically disconnects the internal speaker when you plug in your phones.

The square-wave sidetone is injected after the volume control, so its level is not affected by the setting of the volume control. The sidetone level is set by a PC-board-mounted trimpot. Sidetone pitch is not adjustable.

The Transmitter

Unlike the receiver, the transmitter is quite straightforward. An NE602 is used as a transmitter mixer to supply the proper signal to the transmitter chain. The transmitter offsets the receive frequency by 800 Hz. A filter removes the unwanted frequencies from the mixer, leaving only 14 MHz energy to reach the buffer and then the driver, a husky 2N3866. The final RF power amplifier is a MRF476. This burly and rugged device will generate up to 12 watts of RF. In the A&A Engineering rig, I got a tad over 5 watts output. I could have squeezed more out of the amplifier if I did some fine-tuning to the output coils in the filter network, but 5 watts is more than enough for worldwide communication. A five-pole low-pass filter keeps harmonics from reaching the antenna. Using a 13.8 volt power supply, the transmitter required 770 mA. That's an input of about 10.5 watts, so we are looking at about 60 percent transmitter efficiency. It might even be better if you could eliminate the current from the relay and the sidetone amplifier combination.

Transmit/receive control is provided by a relay. You can set the delay time for the relay

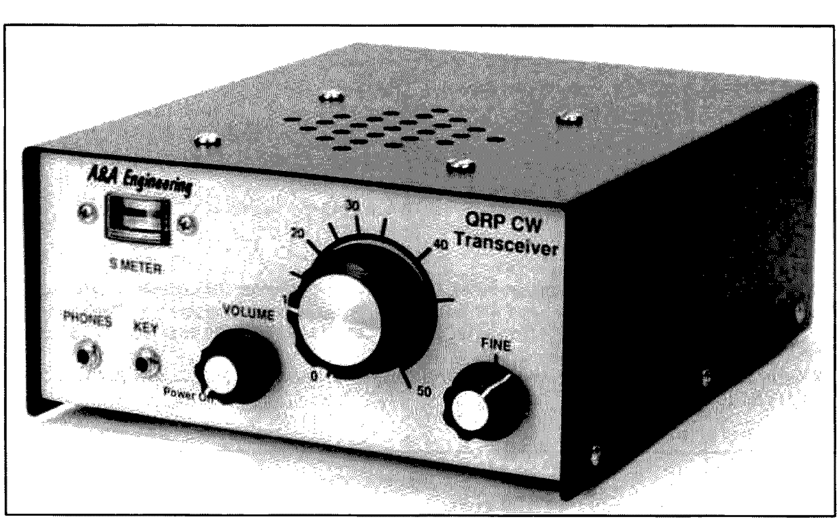


Photo A. The A&A Engineering 20m QRP kit.

by adjusting a PC-board-mounted control. You have anywhere from about a second of delay to almost nothing. The key jack is on the front panel. It's a mini 1/8" jack.

Putting the A&A Engineering Kit Together

The kit comes with a dozen or so sheets of instructions. The original article by Gary is included. The instructions describe the circuit and how to start construction. A block diagram and a full-sized photo of the completed rig is very helpful. There's information on how to solder and how to tell which part is which. However, I would have liked to see some troubleshooting tips with the instructions.

The rig consists of two PC boards, one for the receiver and the other for the transmitter. Each PC board has its own parts bagged separately. The parts placement overlay is silk-screened on both PC boards. The boards are single-sided G-4 Fiberglas. The boards are solder-reflowed, too.

You assemble one board, then move on to the other. After both boards are assembled, you mount them in the case using the supplied hardware. Interconnections between the two circuit boards and the real world are done with test points. These test points (loops of metal with a plastic holder) solder in along the edge of the circuit boards. You connect the two boards by soldering directly to the test points. This way, you don't have to remove a board to solder the wires. Chassis wiring is not too complex. Drawings show you what goes where. In fact, I used the drawings and did not read though the remaining construction details. A&A Engineering supplies all the necessary wires and miniature coax with the kit. An SO-239 antenna connector is used for the antenna connection.

There are three coils you must wind for the rig. The instructions make this about as clear as humanly possible, and the drawings are there to back up the text so you should not have any trouble with the coils. I did find that the burn-away insulation on the wire did not burn away like it was supposed to. I cleaned the enamel from the wires before I installed the coils to the PC board.

Because the main tuning control is a pot, it's a lot easier to mount than a variable capacitor. In a way, this adds to the mechanical stability of the rig.

All the parts mount in a ready-to-use cabinet. It's nice-looking, with silk-screened labels. You get all the necessary mechanical parts to mount the boards in the cabinet. Why, even the knobs are included!

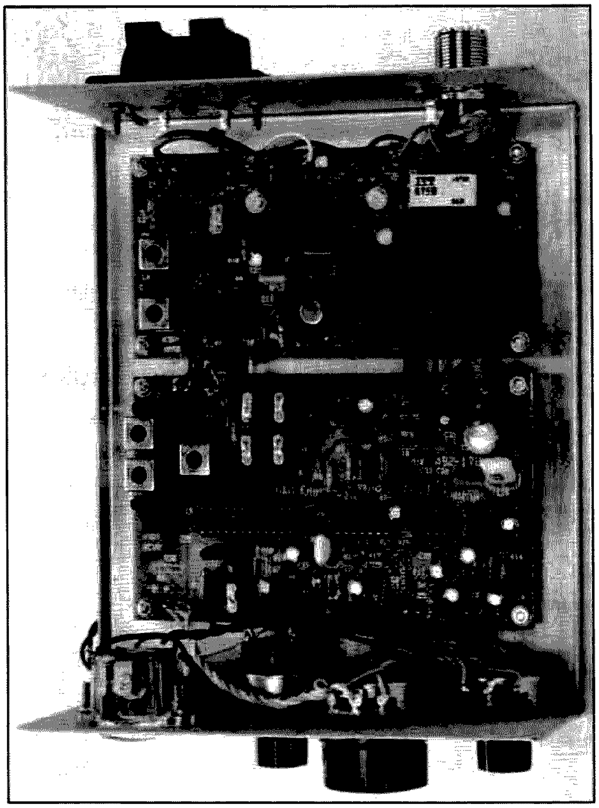


Photo B. All of the electronics fits neatly onto a pair of PC boards.

Tuneup and Adjustments

After you have completed the assembly and after re-checking your work, you must align the receiver and transmitter. This isn't hard to do, but you'll need some test gear. Tuneup is easiest if you have an oscilloscope; if not, you can use a general coverage receiver. A frequency counter is very handy to have. It's real difficult, but not totally impossible, to set the VFO frequency without one. A source of low-level RF is also required. Of course, a dummy load and source of power are also required. A wattmeter will come in very handy for the transmitter's tuneup.

There are several slug-tuned coils you must adjust. I would have liked to see A&A Engineering supply the necessary tuning tool. It's way too tempting to use something other than the proper tool.

If you don't have the proper test gear, all is not lost. A&A Engineering will align the rig for you for only $20 plus $5 shipping. It's not a bad offer and I'm glad to see it's available.

Tuneup went smoothly until I reached the transmitter. There was no output from the rig, even though I measured almost 1 amp of current at keydown. I traced the problem down to late-night kit building in conjunction with stale Oreo cookies and flat Diet Coke. I had a solder bridge on the output filter of the rig. All my RF was going directly to ground! The solder bridge was a big hunker, too. You could see it from across the room. I removed the solder bridge and the transmitter snapped up to full power. It's interesting to note that the final did not suffer any damage from the shorted output.

If you can't get the rig to work, A&A Engineering does have a repair service; repair and alignment is $55 for the rig.

On-The-Air Results

By now, you want to know how it works? Well, it works very well indeed! The receiver is plenty sensitive, and can stand up with the best of them. The dynamic range is better than most of the monobanders I've used in the past, but it's not as good as some commercial rigs. A&A Engineering says the dynamic range is 70 dB.

The AGC works very smoothly and there is little pumping of the gain. A really strong signal close to the desired signal will grab the AGC. This is to be expected and is not really a flaw with the rig. As I mentioned earlier, the rig sounds good. It's nice to just keep it on in the background to listen in on the bands.

With its 5-plus watts of RF, contacts were easy to make on 20 meters. The semi break-in keying works very well with not too much noise from the relay. The sidetone, while only a square wave, is not half bad.

Rough Edges

As noted in the original article, temperature stability of the VFO is not one of the best features of this rig. In your shack, you'll have no problems; out in the woods, it's going to move on you.

You have no idea at all where you're at on the band. The tuning is not very linear. Tuning is way too fast with the main tuning control. You can move 50 kHz with a flip of your wrist. The fine-tune control will be used most of the time.

Without a RIT control, you could find yourself hopping across the band when you work someone. I can just image the amount of ground you would cover if you work a guy with an HW-8 on the other end.

Kudos

Of all the monobanders I've built and reviewed, this one went together easier than most. Its superhet receiver provides single signal reception, with a smooth-working AGC. The transmitter has enough bite to make 20 meters interesting, even if you're not a diehard QRPer. And, the completed rig looks and sounds great. Operation is simple. The only controls are the off/on volume and station selector.

The case design will make troubleshooting easy if required down the road. You can remove a board without too much hassle. The A&A Engineering alignment and repair policies seem very reasonable.

If you want to try QRP and assemble a kit at the same time, you'll be happy with the results of the A&A Engineering rig. Gary succeeded in designing a rig the average ham can duplicate and have fun with.

73 Review

Number 7 on your Feedback card

by Peter J. Bertini K1ZJH

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State MS 39762
Telephone: (601) 323-5869
Orders: (800) 647-1800
Fax: (601) 323-6551
Price Class: $220

The MFJ-9420 20 Meter QRP Rig

MFJ's new QRP SSB station for 20 meters.

What good is a 20 meter SSB QRP transceiver? I kept mulling this over in my mind as I unwrapped the newly-arrived MFJ-9420. After all, all my previous experience on 20 meters was based on my activities as a serious DXer; I rarely ventured onto this band unless the trusty 2 kW linear was online and ready for battle.

Plays Right Out of the Box

Within several minutes the radio was up and running—the MFJ-9420 is ready to plug in and play right out of the box. Just connect an antenna, a 13.8-volt power source (I used the optional wall-plug power pack) and the optional hand mike, and the radio is ready to use. Tuning the usually crowded band yielded some surprises: The MFJ receiver is a real performer. Under the tiny hood a well-designed six-pole crystal filter gave good single-signal performance that rivaled some of the full-sized multiband HF rigs I have owned. The rig covers the American phone band from 14,150 to 14,350 kHz. MFJ uses a custom-made 4 to 1 vernier drive capacitor, along with an analog dial scale calibrated in 10 kHz steps. Besides the tuning, only three other controls are provided—a volume control, power switch, and tune switch.

Internal Speaker, AGC and S-Meter

An internal speaker is mounted under the cabinet cover. No skimping here, the speaker is 3.5" for good fidelity and volume, and faces upward where it will do the most good. The designers used a bridge-type audio IC for some real AF power.

Another surprise for a radio in this price class was the inclusion of an S-meter that is fairly accurate—a 50 μV signal from my signal generator produced the desired S9 meter reading. Another nice touch was including backlighting for the meter. The AGC, which is derived from the audio, was also smooth acting, without "thumps," overload, or other glitches being noted. I parked the MFJ-9420 on several net frequencies for hours at a time, and no drifting was noted. I also found that I was able to quickly find and tune to the DX stations spotted on the local PacketCluster node.

Working DX

Working the DX stations spotted on the DX Cluster was another story. Basically, this is a QRP radio, and even with 12 watts output, some discretion is needed in a pileup. I tried the usual ploy of yelling my call, followed with a plaintive, "QRP . . . QRP . . . ," but, alas, this usually resulted in several competing stateside stations responding with catcalls of disbelief. Abandoning the DX Cluster with its self-generated pileups yielded much better results. By finding a clear frequency and calling CQ, or better yet, careful tuning and finding the DX first, I quickly filled two or three log pages with European, South American, and Caribbean stations. Almost all of the reports were S9 or better, and were given before I disclosed my transmitter power.

The Transmitter Has Punch

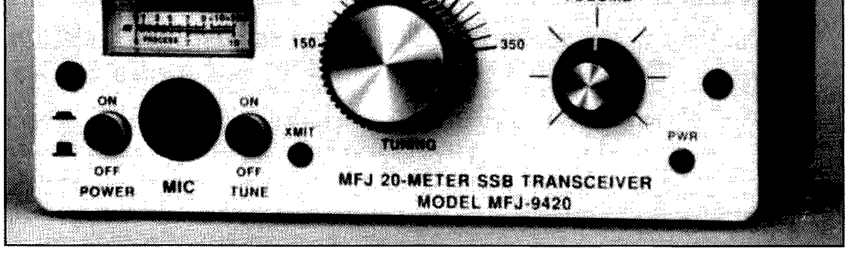
Used with the optional AC wall adaptor power supply, the transmitter will deliver about 9 watts output.

Going to a 13.8 VDC source, such as batteries, will produce 12 or more watts of power. The "tune" button locks the transmitter on, and gives about 5 watts of carrier for adjusting an external antenna tuner, when used. The Motorola final transistor used in the MFJ-9420 is rated for 40 watts, so it is unlikely that any sort of mismatch will damage it.

MFJ proudly advertises their new "constant carrier" RF speech processing system in the 9420. This is simply a transmitter ALC circuit with a very fast decay time that permits the transmitter to follow voice peaks and valleys so that the average transmitter power is always maintained at a fairly high and constant level. The transmitter ALC action is monitored on the S-meter during transmit. This probably yields results similar to what a good AF speech processor would do: in the order of a 3 or 4 dB improvement in my readability to another station. In any event, while a true RF clipper would give more talk power, it would also double the cost of producing a radio in this price class. And besides, an honest 3 or 4 dB improvement is nothing to sneeze at. DX stations commented favorably on the audio punch of my signal, and a few noted that their S-meters barely wavered while I was transmitting.

Technically Speaking

What's inside? In my opinion, the designers really did their homework on this American-made set. Many of the stages do double duty between receive and transmit, most notably the AGC/ALC and IF stages. The radio is a single conversion design, with a 10 MHz IF and the VFO running in the 4 MHz range. The front end is a NE602 serving as the RF mixer and VFO. CAD-designed bandpass filters are used in the receiver front end and transmitter driver stages. NE602 mixers are used for the product detector and transmitter mixer stages as well. The IF stage is a single MC1350 IC, followed by the six-pole ladder filter. Most of the circuitry is IC; in a quick



peek inside I counted seven eight-pin ICs and a small handful of discrete active components. A miniature antenna relay is used—no antenna switching diodes to burn out here.

What I Didn't Like

It was hard to find any fault with the radio since, even though my set was from the first production run, no problems have been found. One thing I noticed was that the large amount of IF and RF gain during transmit, all following the IF ladder filter, did produce a transmitter white noise floor that could be a problem when used in close conjunction with other 20 meter stations, such as during Field Day. But, please note that the transmitter does meet current FCC specs for spectral purity.

I also missed having a RIT control, my voice is slightly bassy, and stations have a tendency to off-tune my signal so I sound better to them. Including an earphone or external speaker jack on the rear apron would be an useful addition.

What I Did Like

Almost everything! The case is solid and well-made. The tuning is smooth, thanks to the vernier drive and hefty 1.25" tuning knob; and the dial is accurate and the VFO is stable. The speaker size and placement is ideal for good volume and audio clarity. I was impressed with the IF ladder filter performance, and with the AGC action and the inclusion of a backlighted analog meter. These are nice touches for a radio in this price class and for its intended QRP audience.

Twelve watts and the RF processing system used by MFJ will produce contacts. You don't have to be an experienced QRP milliwatt masochist to enjoy QRP! Yoy can see fine results without the usual frustration encountered by some beginning QRP enthusiasts. And the radio (it measures 2-1/2" x 6-1/2" x 6.0") battery supply, mike and a simple wire dipole can easily be toted in a small gym bag to exotic DX locations or on your next business or camping trip. To sum it up, MFJ's 9420 is a winner! 73

Number 8 on your Feedback card

by Mike Bryce WB8VGE

TechSonic
1642 Butler Pike, Suite 127-F
Conshohoken PA 19428
Telephone: (610) 834-1978
Price Class: Single Band Kit—$29.95; Built—$39.95; Metal Case—$9.95; Band Packs (incl. Xtals)—$9.95; Milliwatter Deluxe (kit, case, and 3 band conversion packs)—$54.95.

The TechSonic Milliwatter

It's easy to build your own QRP transmitter!

There's an upswing today in the number of soldering irons burning at night. Perhaps it's the QRP bug biting both newcomers and old-timers alike. For those wishing to get their feet wet in low power ham radio, I may have the perfect solution. It's called the Milliwatter, and it's from the people at TechSonic.

The Milliwatter

The Milliwatter is a basic QRP transmitter that is so easy to assemble, anyone could do it. The Milliwatter provides several watts of RF on many of the popular ham bands. Of course, you can put the Milliwatter on only one band at a time. I assembled the Milliwatter for use on the 40 meter band (a great place to work other QRP operators, too).

You can put the Milliwatter on just about any of the ham bands by installing a different band pack. However, you must first remove all the components from the band you want to remove and then install the new parts. The manual advises you to keep the parts you remove so you can install them in again if you want to change bands. I'm not sure I like this idea. It would seem to me that, unless you are careful to avoid excessive heat, the copper on the PC board might begin to lift up and cause you trouble after a number of band changes. *[In all fairness, the factory says this has not been a problem so far.—Ed.]* Each band kit comes with all the necessary components and a crystal. All the coils come prewound, too.

QSK On Board

The Milliwatter has provision for electronic antenna switching QSK. The diode switching is very fast, and of course quiet. There is a loss of signal going to the receiver when using the QSK circuit. Using my old Drake R4B, I noticed the attenuation by jumping the QSK circuit in and out of the antenna line. The Milliwatter does not provide a sidetone, either. Since the QSK system does not mute the receiver, you can listen to your own keying. There is no *spot* function either, so you must key down at full RF output to find your signal on the band. Use a dummy load and not the antenna for spotting.

The Kit

The Milliwatter comes with all the parts necessary to get on the band of your choice with as little pain as possible. It comes with a small PC board, all board mounted parts, and a crystal for the band in use. Since I chose the 40 meter band, the crystal came on the QRP calling frequency of 7.040 MHz. A nice touch!

Assembly

Assembly is straightforward. The instructions are clear for the most part, with an error popping up here and there. These were simple enough to see through, and should cause no trouble with the kit.

There is no wiring to be done with the Milliwatter. Every connector is mounted to the PC board. This includes the antenna, power and receiver jacks. RCA-type jacks are used for the RF connections and key while a coaxial jack is used for power.

Each step is spelled out in simple terms and each stage is explained. The manual contains an oversized parts overlay, but no PC board pattern. A schematic is also included. Techsonic has recently revised their assembly manual in response to customer feedback.

The PC board, about the size of a playing card, is fairly open, with trace spacing wide enough to prevent solder bridges—a big plus to the new builder. Stuffing the board is quite simple. However, some of the resistors are mounted on end, and this may confuse some people.

The Milliwatter does come with quite a few surplus parts. And while there is nothing wrong with that, sometimes parts don't exactly fit the PC board. The capacitors were especially hard to fit. In fact, the 0.1 caps went from the kit into the junk box and I used my own supply of 0.1 caps to finish the board. *[Factory note: Currently shipped caps drop perfectly into the holes.]* One capacitor had no markings at all. During assembly, a 100 pF capacitor was called for. I could not locate this part in the kit, so I suspected it was missing. After the rest of the parts were installed on the board, I had one leftover capacitor—

the unmarked critter. I decided I had three choices. I could dig up a 100 pF cap in my junk box. Naw, that would take a week. Or, locate my capacitor checker. Nope, that would take a month. Or, solder in the mystery capacitor. That's what I did and everything worked out just fine. *[Factory note: The 100 pF caps have been remarked at TechSonic to avoid confusion.]*

Don't get me wrong, there's nothing wrong with surplus parts. Hey, if they're good enough to go in an M1A1 tank, they'll work just fine in my QRP transmitter. The biggest problem with surplus parts is getting them to fit the PC board. For instance, a 0.1 cap on 0.5" lead spacing will be a rough fit on a PC board with holes laid out for 0.2" spacing.

Frequency Control

The Milliwatter uses a VXO to move the crystal's frequency around. In my kit, I could move from 7.049 to 7.053 MHz with the VXO capacitor. It's interesting to note, the VXO capacitor is a small trimmer mounted on the PC board. It's not a panel-mounted control. In fact, if you are going to mount the Milliwatter in its optional case, you're instructed to solder the VXO trimmer capacitor on the foil side of the PC board. I'll talk about this again.

The Milliwatter is keyed in the oscillator circuit. Keying is just about right: not too hard and not too soft. The Milliwatter does not sound like your typical QRP transmitter. Depending on the supply voltage, the RF output from the Milliwatter will be from milliwatts to several watts. With 3 watts of RF, I was able to work all over the East Coast, with some W6s thrown in for good measure, despite the bad conditions on 40 meters.

> ***"The Milliwatter is easy to build and provides a lot of fun for first-time kit builders."***

What's Cool

The Milliwatter is easy to build and provides a lot of fun for first-time kit builders. The crystal VXO gives enough frequency swing to prove useful. Mounting all the inputs and outputs directly to the PC board eliminates mistakes during assembly. Including a crystal with the kit is great. It's a well-thought-out circuit that works quite well. The KISS standard is working here. Perhaps the best part about the Milliwatter is its cost, well within the reach of every ham, regardless of their budget.

Not Cool

The optional case for the Milliwatter is nothing special. It's imported and, while it is painted and silk-screened and punched (and I do mean *punched*), I could do better.

Putting the VXO capacitor on the foil side of the PC board and then mounting the board into the case means you have to turn the rig over to adjust your transmitter's frequency. Then you must hit the trimmer through the hole with a tweaker of the correct size. These small trimmer capacitors were never meant to be tweaked and tweaked all the time. I suspect you could easily wear out the trimmer capacitor in a short time. There should be a spot button to let you find your transmit signal without going on the air (or dummy load).

All In All

The Milliwatter is a dandy way to get your feet wet in the exciting field of QRP. It's simple and easy to build. For the money, it's a hard act to follow. It would be a great club project. Why who knows, maybe the Milliwatter will make you dig out your soldering iron! 73

Handy Randy

The tiny tag-along almost *random wire tuner for QRP.*

by Donald L. Shipman W3RDF

In the October 1988 issue of the *ARCI QRP Quarterly*, I described a toroid-loaded kite-supported antenna and the fun of operating a small 30 meter station from the beach. Since then I've successfully used this toroid-matching technique in hundreds of setups with varying lengths of wire, with and without the kite. Most recently I used the technique while operating from several small islands in the Baltic as OH2, and from the Arctic as OH9. With a toroid-loaded wire, woven through tree branches not very high off the ground, I enjoyed hundreds of contacts and many fine rag-chews with hams all around Europe and Western Asia. These experiences led me to develop a little jewel which now accompanies my QRP rigs every time they leave home. Although, it's not truly a random wire tuner, since you can't vary the inductance, I've decided to call it "Handy Randy."

Handy Randy is for the QRP operator who likes to operate from remote places but doesn't want to carry a lot of extra weight. It's for the operator who wants to spend more time operating than trying to properly situate a well-designed antenna. It is not for the QRO operator. I would never use this tuner in a QRO environment—there's too much stray RF to burn my fingertips and make my keyer go haywire. In fact, whenever possible I ground my transceiver to provide a more stable tuning environment. Never underestimate the importance of a good ground.

Handy Randy is quite simple and inexpensive to build. It's lightweight and takes up little space, yet performs like a real champ. As you can see (Photo A), Handy Randy is housed in a 35mm film container. C1, a ceramic compression trimmer with a quarter-inch shaft, is attached with a screw to the container lid, and L1 is attached to C1. A short length of coax feeds through the back wall of the film container and the tuned output attaches to a random length of wire with an alligator clip. I've found it helpful to insert some additional capacitance in series with some random wire lengths while operating in the 40 meter band. I carry a 100 pF mica with a miniclip on one end (Photo B) for insertion between the tuned output and the random wire, if needed.

Construction

The value of C1 isn't critical as long as you can obtain enough capacitance and can reduce it to a few picofarads. I have an RLC bridge and the one I used ranged from 10 pF to slightly over 400 pF. L1 is wound on a ferrite toroid (Figure 1). I used an FT82-61 from Amidon Associates (12033 Otsego St., North Hollywood CA 91607) and wound a total of 14 turns of stranded number 20 hookup wire (Radio Shack #278-1219). The coil is tapped six turns from one end. The center conductor of a convenient length (18 to 30 inches) of 50 ohm coax (RG-58U, etc.) was soldered to the coil tap and the braid to the six-turn end of the coil. The ends of the coil were then soldered to the tabs on C1, and, at the same time, a short piece of hookup wire was soldered where the eight-turn end of the coil meets C1. The coax and the wire were fed through small holes in the bottom of the film container pulling the container and the lid together. A PL-259 was attached to the coax and an alligator clip to the wire. Finally, a small knob was placed on the shaft of C1.

Testing

The whole project took only a few minutes. Locating the right trimmer with a mounting bracket and shaft took the most time. I had accumulated several from hamfest flea markets. The first test was conducted with a 150-foot wire and 5 watts on 30 meters. With a few twists of the trimmer a 1 to 1 SWR appeared. Hand capacitance around the film container had some effect but a flat SWR was easily found.

Next I connected Handy Randy to a 20 meter QRP rig. A slight adjustment to C1 netted a nearly flat SWR. It was difficult to get the SWR below 2 to 1 when applying a 40 meter signal, but after inserting a 100 pF mica in series with the antenna the SWR dropped to about 1.2 to 1. I again tuned up on each band and made several contacts.

If you have difficulty, try a wire that is 1.2 x the wavelength of the operating frequency. Example: Here is a sure thing for the low end of 40 meters. Use 7025 as the target frequency. Using the halfwave dipole formula:

$$\frac{468}{7.025} = 66.619' \times 2 = 133.238' \text{ (fullwave)} \times 1.2 = 159.8'$$

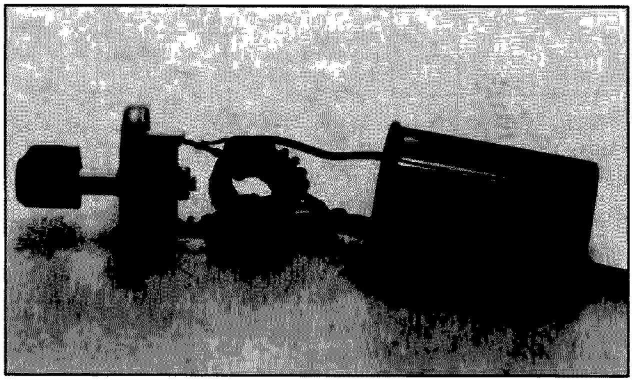


Photo A. The whole works to Handy Randy fit neatly in a common film container.

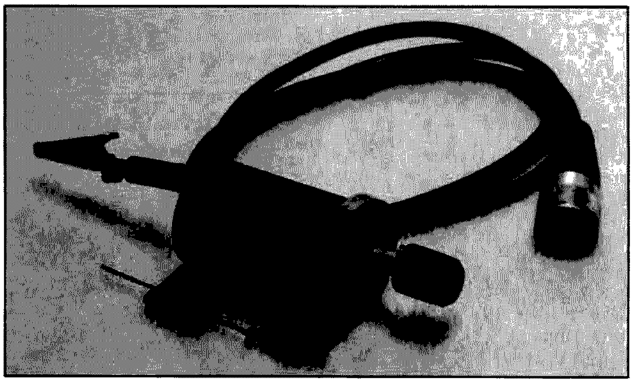


Photo B. You may want to add a little capacitance for best results, so keep one on hand with an alligator or mini-clip. (See text.)

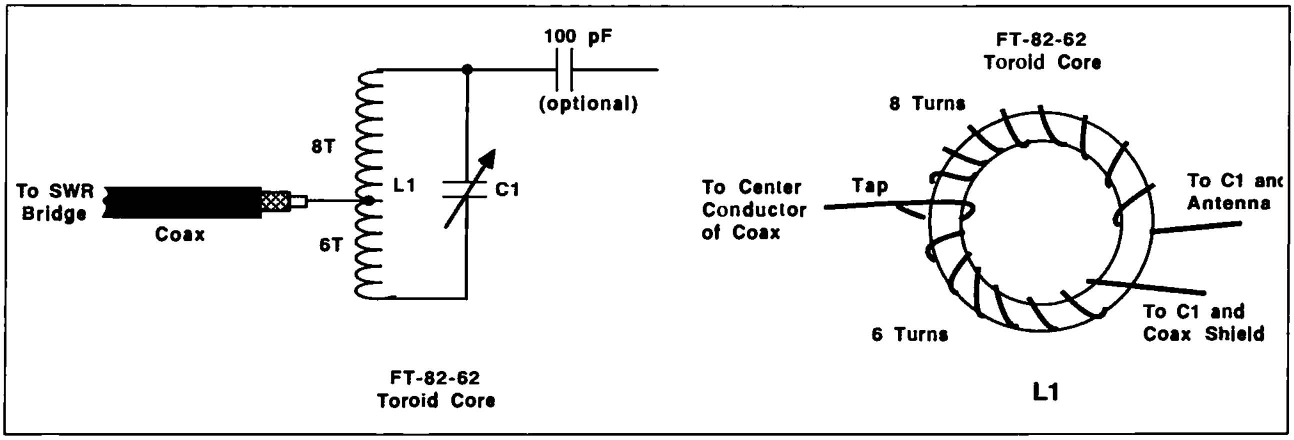


Figure 1. Construction of Handy Randy.

A 160' wire will load like gangbusters. If space is a problem, use less than a full wavelength. Use .667 x wavelength. For 7.025, the full wavelength is 133.238'. 133.238 x .667 = 88.9'. You'll be surprised at how well this will work—just remember to ground your rig.

I seldom know what I'll have to deal with when it comes to stringing an antenna so I usually carry an assortment of wire lengths which can be clipped together to give me several length options. Each length is made from #20 insulated, stranded, hookup wire and each has a small fishing swivel attached to both ends. Also, at one end of each wire I've soldered a three-inch jumper wire, terminated with a small alligator clip. The lengths can be coupled together by connecting the swivels and by attaching the alligator clip jumper to ensure continuity. A large rubber band serves as a handy insulator if I need to use one of the wire lengths as a convenient support line to reach a tree limb.

I always run my QRP stations from batteries when they're away from home. A 12 volt, 7 Ah Gel Cell lasts several days without recharging, and although it weighs a lot it's easy to carry and doesn't take much space. Once the power is connected and the antenna is tuned I'm set for hours of operating fun. However, I'm always aware of the fact that, if I change anything, like adding a ground or connecting a battery charger, I'll have to retune Handy Randy. After all, the whole glob is part of the antenna system.

Build the Quickie Cheapie Tener

Perhaps the easiest way to get a 1 watt CW rig for the 10 meter band.

by Fabio Veronese

Who says that one-transistor transmitters necessarily have to be unreliable toys? The output power may not be so high—that's quite obvious—but, if you choose the right project, you can be sure of building a little, perfect QRP transmitter while spending less than five bucks and with minimum effort.

The 1 watt, 10 meter CW rig that's described here uses only 11 cheap, readily-available parts and their values aren't critical at all. This means that it will work as soon as its power supply is connected, assuming that all connections are right and are kept reasonably short and direct.

It's a winning card for young experimenters taking their first steps as hams, and for older people who have never tried to build an RF circuit or who enjoy QRP operating.

A Look at the Circuit

Figure 1 shows the schematic diagram of the Quickie Cheapie Tener. It's nothing more than a quite straightforward Pierce crystal-controlled oscillator with tuned output, equipped with a medium-power NPN silicon transistor, like a 2N3866 or similar device.

Basically, this circuit is a common-emitter amplifier. Resistors R1 and R2 set a proper polarization voltage for the base, while R3 plays the same role for the emitter; that is, RF is bypassed to ground by means of capacitor C3. The connection of the XTAL (crystal) between the Q1 collector and base creates a feedback path that causes the stage to break into oscillation at the crystal frequency that may be modified by a few kHz by acting on trimmer capacitor C1. Fixed capacitor C2 just prevents collector DC from uselessly affecting the XTAL, and has practically no effect on output frequency.

The collector circuit is tuned at crystal frequency by means of a toroidal inductor (L1) and a trimmer capacitor (C4) connected in parallel. A two-turn link, L2, allows the output signal on L1 to be fed to a resonating aerial by a coax cable. Capacitor C5 bypasses supply voltage and at the same time creates an RF path to ground for the output-tuned circuit.

The transmitter requires a 12 to 20 VDC regulated power supply; this should deliver a continuous current of at least 300 mA.

Building the Quickie

The Quickie Cheapie Tener may be assembled just as you like, as long as you keep in mind that connections must be kept as short as possible. So, you can build it on a small piece of perfboard, or pick up a scrap of unetched PC material and adopt the "dead bug" technique. If you prefer a smarter and longer-lasting solution, just etch the PC board shown in Figure 2 (or better yet, drilled and etched PC boards are available for $3.75 plus $1.50 S & H per order from FAR Circuits, 18N640 Field Court, Dundee, IL 60118). After etching, cleaning and drilling (use a #74-size drill bit for all holes), take a look at the parts layout shown in Figure 2 and start with installing resistors. Then go on with fixed and trimmer capacitors, and finally solder Q1 and the XTAL—unless you prefer to use a socket for this last item.

Now it's time to wind up the coils. You need a small Amidon toroid core, like FT-37-2 or FT-37-6. Slightly different toroids will do if the ferrite mix is suitable for frequencies up to 30 MHz or more. Inductor L1 consists of 10 turns of #24 enameled copper wire; L2 is a two-turn link wound between the ends of L1, still using

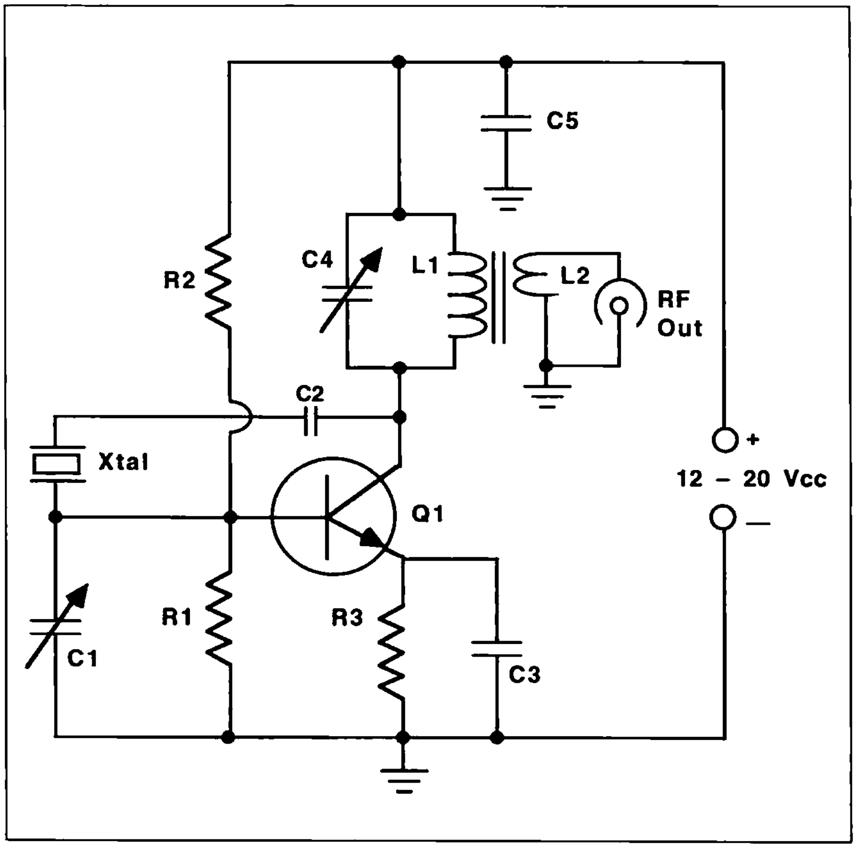


Figure 1. Circuit diagram for the Quickie Cheapie Tener, a 1 watt 10 meter transmitter.

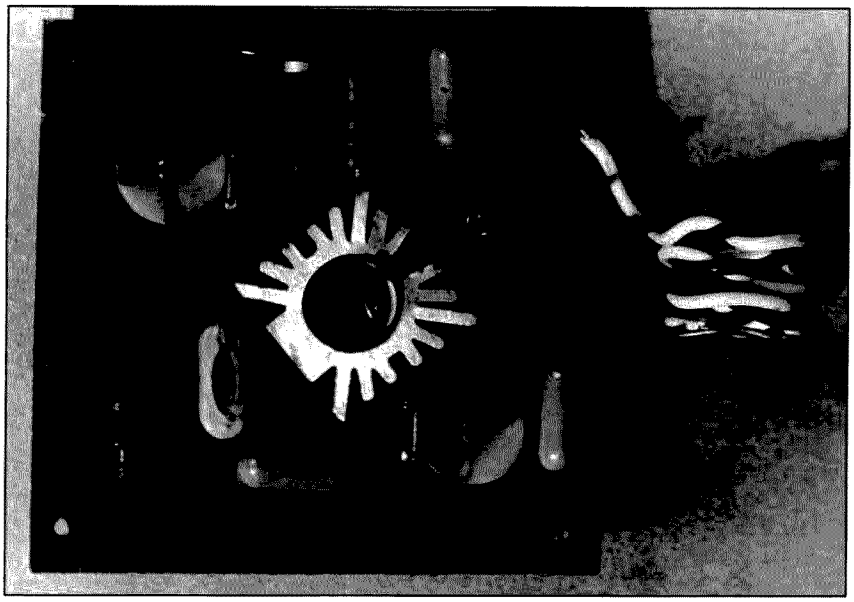


Photo A. The assembled 10 meter rig.

#24 wire. Before soldering L1 and L2, scrape away the enamel from the ends of the windings (about 1/4" is enough) with a sharp blade, then pre-tin them using an hot soldering iron.

Parts List

Q1	2N3553, 2N3866 or similar medium-power NPN transistor
XTAL	28,000 kHz miniature crystal
R1	5.6k resistor
R2	15k resistor
R3	330 ohm resistor
C1,C4	10-60 pF trimmer capacitors
C2,C3,C5	0.1 μF ceramic or polyester capacitors
L1,L2	Coils; see text

Misc.: Crystal socket, PC board, case.

Tuneup

If an outdoor antenna resonating on 28 MHz is not available, temporarily connect 5 to 10 feet of insulated copper wire to the output of the Quickie. You may also use a "dummy load" made by a small filament lamp—say, 6V, 100 mA. Its brightness will roughly tell how much RF energy is coming from the transmitter output. Put a communications receiver near the transmitter board and tune it to the XTAL frequency. Connect the Quickie to the power supply and slowly turn C4 with a plastic screwdriver (don't use metal tools!) until you can receive its carrier. Adjust C4 for maximum reading from the S-meter of your receiver, then set the exact transmission frequency by means of C1.

This completes the tuneup of the transmitter. To send CW, connect a key in series with the positive or the negative rail of the power supply. It's advisable to put a 100,000 pF ceramic capacitor in parallel to the key in order to reduce manipulations or "clicks" due to current transients. If you have an FCC license, you are now ready for your first Quickie-QSO (. . . or Quickie-DX, who knows!). Otherwise, just leave the dummy load lamp in place and use your brand new rig to take some exercise in Morse code.

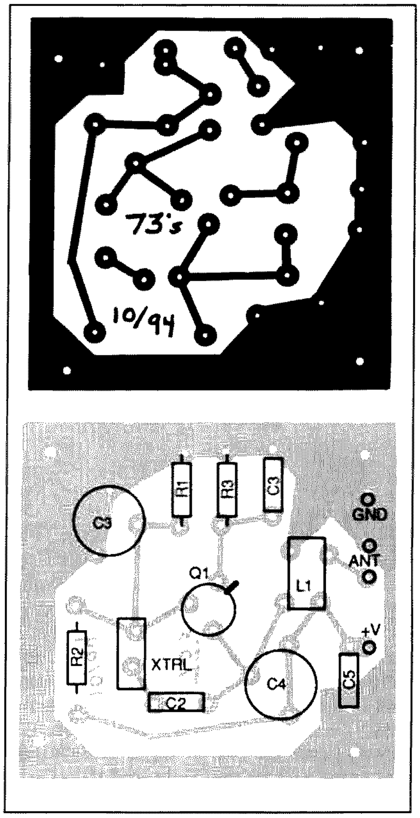


Figure 2. PC board foil pattern and parts placement.

The Capacity Tuned Folded Loop

A 1/3-wave, 7-foot, 20 meter antenna.

by Jim McLelland WA6QBU

The Capacity Tuned Folded Loop (CTFL) is a compact antenna that puts out a respectable signal on 20 meters and it will also let you tune other bands between 40 and 10 meters with a tuner. It is a wire loop that is inexpensive, simple to build, and you can hang it up anywhere. If you're like me and aren't allowed to put up an outside antenna, the CTFL may be a good HF option. The design is based on one of those brainstorms that come late in the night and haunt you until you try it out to see what will happen. (The XYL says I've been haunted for years, and points to all the strange noises that come from the shack when I'm in there.) Try it! You won't be sorry.

The Antenna

The CTFL is a small wire loop designed primarily for single-band HF operation. It is a folded dipole, shortened until the impedance drops from the typical 300 ohms to 50 ohms, then bent into a delta loop, with a capacitor between the ends to tune it back down to the original resonant frequency. It's then fed through a half-wave length of twin lead that terminates in a 1:1 balun at the tuner and SWR bridge. You could put the 1:1 balun at the antenna and use coax, but I wanted the option of using my tuner to resonate the CTFL on other bands and twin lead is more efficient in this respect. Although the CTFL is probably at its best on the design band, it will work on the others. But, if you can work it out, it's better to have one antenna for each band of interest.

With this system, you get a self-resonant antenna on 20 meters with a 2:1 SWR bandwidth of about 280 kHz and an impedance of 50 ohms. I found that I could easily resonate on the center of the phone band and run up and down the band without need of the tuner and stay below 2:1 SWR. Even moving to the bottom of the CW portion only required minor tuner touch-up. Another interesting point is that you *do not* need a good ground to make it work. Some kind of ground is always a good idea to help with RFI and RF feedback, but it is absolutely not required to make the loop work efficiently.

Construction

Take a look at Figure 1. All the lengths are based on the characteristics of Radio Shack 15-1153 5/16" twin lead (get two rolls if you want to feed it with twin lead). Other varieties will require somewhat different lengths, especially with the capacity tuning stub. Cut the 20 meter loop to 24' 8", short both ends together, and open one conductor halfway between the ends for connection of the feedline. Keep in mind throughout the project that all connections should be twisted and soldered. Further, you need to use shrink tubing everywhere possible for both added strength and insulation. A little planning here will save you a lot of grief later. Now solder a 24" open stub to the ends. Then, cut 27' 10", or some multiple of it, for your feedline (half-wave with a velocity factor of 0.80) and solder it on. Keep the loop end spacing constant at about 1" by attaching a short piece of rope with shrink tubing. Now all you need is a 1:1 balun on the rig end of the feedline and you're done. You can buy a balun, although they're easy to make. Ten to 15 turns of RG-58/U in a 6" coil will work fine, or you can wind some RG/174/U on an open ferrite form that Radio Shack sells. You can also use a 4:1 balun like the one that's probably in your tuner, but then you'll have to use the tuner to match the system.

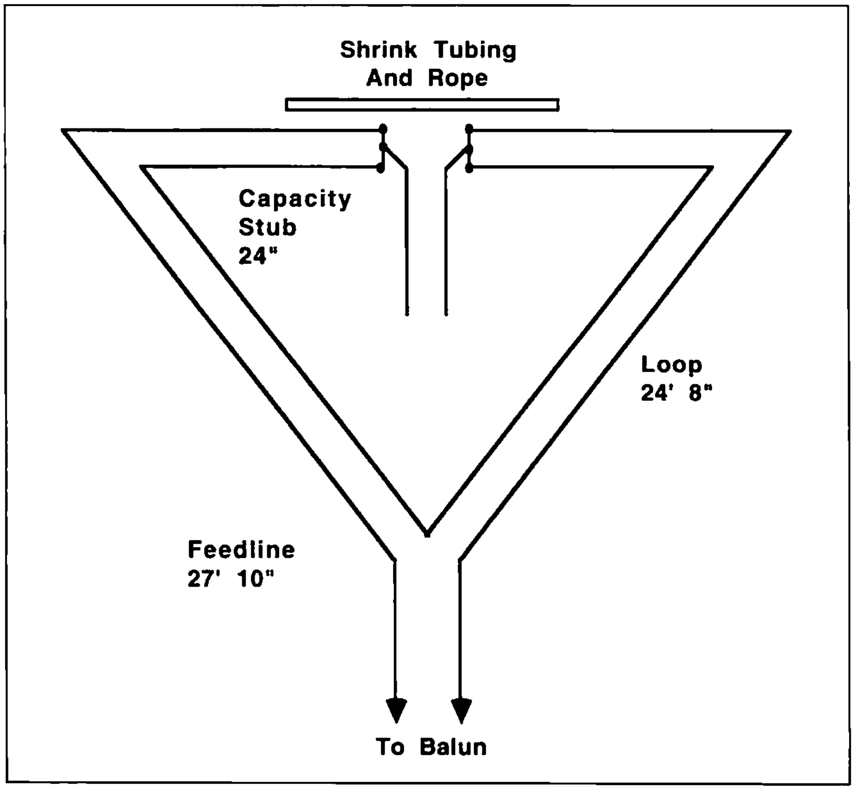


Figure 1. The Capacity Tuned Folded Loop. Use these dimensions for 20 meters.

Installation

If your loop is quite close to the ground, install it vertically. Keep in mind, however, that the loop has directivity perpendicular to its plane. Therefore, if you have a favorite direction and your space will permit it, point it that way. You can also reduce interference, if that's a problem, by positioning the loop sideways to the noise or stations you want to reduce. If you've got a two-story house, you can mount the loop horizontally in the attic. I've tried both at the same time and usually closer stations are better horizontal whereas I hear DX better when its vertical. Being able to easily switch back and forth between two antennas keeps the QSO going awhile longer. Install the loop as an equilateral triangle if possible.

Changing the feed angle tunes the loop up as the feed point angle gets wider and the impedance goes up also (60 degrees = 50 ohms and 90 degrees = 100 ohms), so it should be stable before trimming the stub. Stay away from metal objects and use insulating material for mounting purposes. If you mount the loop vertically, feed it from the bottom, and keep the line away from metal objects as well.

Tuning

Built as described above, the CTFL is probably resonant at the bottom of the band, depending on your loop angle and proximity to objects. Using an SWR bridge, find the dip near 14 MHz. To raise the frequency, just trim 1/2" pieces from the capacity stub until it resonates where you want it. If you don't want to bother, just use your tuner and it'll work fine. If you're a real stickler, use an antenna bridge and you can get it right on. That's what I did but I really don't think it matters that much with a tuner.

Testing

Does it work indoors? Yes—yes—yes! With no tuner on 20 meters, I've been able to work all over North America with the loop hanging on a door. Often, signals were the same as my reference antenna in the attic.

I think you cliff dwellers are going to like this one. Try hooking it to the XYL's hanging plants like I did and see what happens. Ha-ha.

Parts List

Twinlead—5/16"	100'
Shrink tubing—3/8"	1'
Shrink tubing—3/16"	1'
Banana plugs	2
Dacron line	50'
Double split twinlead insulators w/hardware	4

Note: All parts needed to build this antenna can be obtained by ordering the Compact Loop Experimenter's Kit. Introductory price w/shipping (40% discount for *73* readers): $24. Available from Antennas West, 1500 N. 150 W., Provo UT 84604; tel. (801) 373-842.

Notes on Impedance and Matching

A single wire loop of 1/3 wavelength has an impedance of about 13 ohms. This is typical of small loops and, in fact, many designs are down around 5 ohms. Since modem equipment is designed for 50 ohm antenna systems, some sort of matching is necessary. The "folded" design (multiple wires in parallel) was attractive because it is built into the antenna. Further, the impedance multiplying factor can be chosen, depending on how many "folds" are used. The final impedance is determined by multiplying the original impedance by the square of the number of wires in the antenna.

Expressed as a formula: Z(f) = Z(o) x N x N

Z(f) = Final Impedance

Z(o) = Original Impedance

N = Number of parallel antenna wires

For example:

	Z(f) ohms	=	Z(o) ohms	x	N # wires	x	N # wires	Antenna Configuration
1.	13	=	13	x	1	x	1	single wire
2.	52	=	13	x	2	x	2	twinlead x 1
3.	208	=	13	x	4	x	4	twinlead x 2
4.	468	=	13	x	6	x	6	twinlead x 3

The CTFL uses example #2. I settled upon it because it is simple; further, I felt that as I attempted to use the antenna at higher frequencies, the impedance would be less likely to go through the roof. However, I have experimented with example #3 as well and it worked just like the formula said it should. I merely made two identical loops and taped them together, connecting them at their shorted ends and using one capacitive stub and one feedline connected in one of the four wires that now forms the antenna. For a purely single-band antenna, this is a more elegant design and gives a good match with 300 ohm twin lead. One step further would be to use three loops as in example #4 and feed it with 450 ohm ladderlead (available from Antennas West—see the Parts List). Also, more folds should be more efficient since there's more total copper and less current per wire.

Using 300 ohm twinlead with a large mismatch on the line does not cause a loss problem, but some interesting things can happen that must be kept in mind. Let's look first at the CTFL's 52 ohm impedance (#2 above) as an example. When a feedline has a mismatch, it will act like an impedance transformer of some kind, depending on several factors. If it is exactly 1/2 wavelength long, it will act as a 1:1 transformer, *period!* You just have to make sure that you really have a half wavelength. To do this, you must divide 492 by the frequency in MHz, and then multiply by the Velocity Factor (VF) of the feedline to get the length in feet.

For example:

492 /14.14 MHz = 34.8 ft.

34.8 ft. x 0.80 = 27.8 ft. = 1/2 wave at 14 MHz

Furthermore, all of this happens regardless of the line impedance. (If you use coax and roll some of it up in a coil, you also get a balun—see below.) As a side note here, folded antennas do not work at their folded second harmonic. (Think about what your rig sees if the other end of a half-wave line is shorted: You got it, a short!) One leg of a folded loop or dipole is normally a 1/4 wavelength but at the second harmonic (frequency x 2) this equals a short circuit! With the loop described in the article, the second harmonic of the folded portion is about 32 MHz—safe on 10 meters.

Now we need to consider the other extreme, a 1/4 wavelength of feedline. This type of impedance transformer makes major changes and depends on both the line and antenna impedance to determine the final system impedance. System Impedance equals line impedance squared, divided by the antenna impedance. To see how this works, look at the following formula:

$$Z(\text{system}) = \frac{Z(\text{line}) \times Z(\text{line})}{Z(\text{antenna})} = \frac{300 \times 300}{52} = \frac{90{,}000}{52} = 1{,}731 \text{ ohms}$$

As you can see, the system impedance suddenly went quite high, and that's one reason why I went with a half-wave line in the article.

Earlier I mentioned a balun. The reason you need one is to keep the feedline from radiating, and so you don't distort the radiation pattern. The latter may not be so important, but only the antenna should radiate and nothing else. On the higher bands, it doesn't take much coax to make a half-wave (27.8 ft. at 14 MHz) line and if you wind half of it, or more, into a 6" coil, you've got yourself a balun. However, it's frequency sensitive unless you use coax that matches the system impedance. For example, RG/58/U is 50 ohm coax and so is the antenna in the article. As the XYL would say, "Voilà." Now the length isn't even important but I'd stay with at least 1/4 wavelength as a minimum. Hollow ferrite cores made for coax also work well if you use enough of them, but I really like the little snap-apart ferrite core that Radio Shack sells. You can wind quite a bit of RG/171/U coax (that's the little-bitty 50 ohm stuff) on it and it makes a real small balun that you can put at the antenna or anywhere else. I wind as much as I can inside, and some more around the outside, and then tape the whole mess together. I suppose you could use a big piece of shrink tubing or put it inside some PVC pipe but I just use electrical tape and it works fine.

Video-Charge Your HT!

An easy way to quick-charge your handie-talkie with your video charger.

by Michael Jay Geier KB1UM

Having recently purchased a new HT, I found myself frustrated with the tiny wall-cube charger with which it came. It worked fine, but it took 15 hours to charge that little 600 mAh pack. I contemplated buying the quick charger, but the high cost put me off. I was ruminating on the fact that my camcorder came with a quick charger and how indispensable it was, when it suddenly hit me: Could I adapt my camcorder's charger for use with my HT? It seemed like a reasonable idea. After all, the batteries used with most camcorders are normal, quick-charge nickel-cadmium types, just like the ones in our walkies. So, it appeared to be a simple job of connecting the HT pack to the charger. As it turned out, it wasn't quite that easy, but it wasn't all that hard, either.

Apples and Oranges

To get this project working, several differences between camcorder and HT packs had to be considered. First of all, there's the matter of voltage. The Sony-type camcorder I have uses a 6-volt battery, while my walkie, like most, uses a 7.2-volt battery. I decided right from the start that any modification to the camcorder's charger was unacceptable because I still needed to use it to charge the camera battery. So, I sure wasn't going in there and adjusting the charging voltage! As it turned out, it wasn't necessary, because of the charging method these quick chargers use.

Quick chargers don't simply pump continuous high current into the battery; that would overheat the cells and ruin them. Instead, the chargers use fast, short, high-current pulses which force the cells to take lots of current without heating up. Of course, there's some heat, but it's a fraction of what you'd get with an equivalent steady current. The pulses are delivered at up to several amps, and the voltage is high enough to ensure that the cells will take that much current. On my Sony-made, Ricoh charger, the charge output is specified at 10V, 1.3 amps. So, I deduced that the voltage of the battery was irrelevant, as long as it was lower than 10 volts. That turned out to be true.

But, there's another important difference. Camcorder packs are charged through direct connection to the battery terminals. Most HT packs, though, have protection diodes between the cells and both the quick-charge terminals and the slow-charger input jack. (The idea is to prevent a disaster at either of these entry points because NiCd batteries can deliver an *enormous* amount of current into a short.) It certainly would be possible to make a connection plate of some sort that would slide on top of the battery and make contact with the directly-connected output terminals, but that seemed like a mechanical headache; I preferred to go in through the slow-charge jack. Could the camcorder charger work through the diode?

Sort Of

As it turns out, it does work, but with one hitch. There's a circuit in the charger which senses when the battery has finished charging by detecting the slight voltage drop NiCds exhibit at the end of their charge cycle. The diode prevents the detection of the drop. But, the charger doesn't simply charge the batteries into oblivion, as you might expect. Luckily, there's also an error-detecting circuit which notices that the batteries aren't responding properly. This circuit turns the charger off and blinks the charge light to inform you that a problem has occurred. The result is that the charge still proceeds properly, and the charger turns off, but the light blinks instead of simply going out! Ultimately, it is, as Mr. Spock so eloquently put it, a "difference which makes no difference at all." Of course, you can avoid this issue by making a jig which bypasses the diode by connecting to the direct terminals, but I haven't found it to be necessary; everything works fine as it is.

Don't Overdo It

There's one last difference between camcorder and HT packs which needs to be addressed. Camcorder packs usually have at least one amp-hour (1,000 mAh) of capacity, while most standard-issue HT packs are rated at 600 mAh. Even with the diode in series with them, the HT packs will be charged too fast with a camcorder charger. The result will be overheated cells and possible damage ranging from a blown thermal fuse to ruined cells. So, I included a 1 ohm resistor in series with the pack to limit the charging current and slow the whole process down a bit. This arrangement works well with my 600 mAh pack, allowing it to charge, with only moderate warmth, in about 90 minutes. If you bypass the protection diode, you may want to increase the resistor to, perhaps, 2 ohms or even more. But, if you are charging a high-capacity pack with a rating of more than 1,000 mAh, you may not need it at all. Just don't try charging a smaller pack without the resistor, or you'll probably fry the battery.

Building It

The hardest part of this project is mechanical: How do you hook up to the charger? Most of these chargers use a switch which starts the charge cycle when the battery is

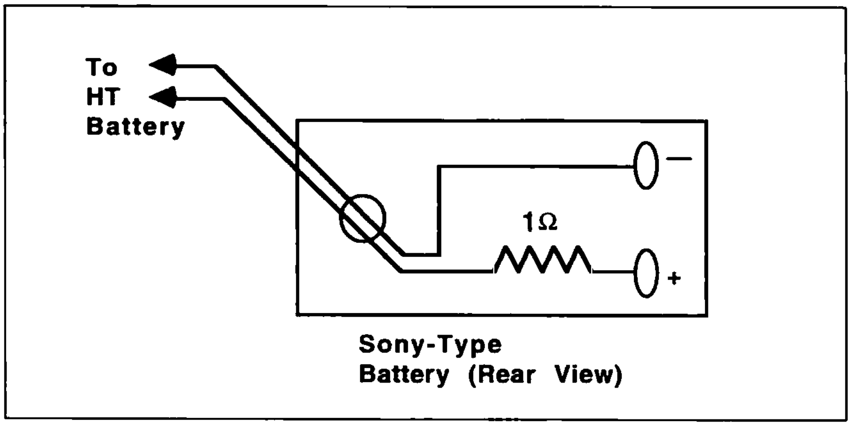


Figure 1. You'll need to get a dead battery pack for this charger conversion.

snapped on the top. Consequently, it can be hard to get them to turn on with anything other than a real battery. The solution is to get an old, dead pack and remove the cells. If you've had your camcorder more than a year or so, you may already have an ailing pack you can gut. If not, ask around. Perhaps a friend has one. If all else fails, go to any shop that services camcorders and, chances are, they'll give you one for nothing. I've obtained a couple of them that way, the hardest part being the explanation as to why I could possibly want a dead battery pack!

Once you have the pack, use an X-acto knife to carefully cut it open along the seam which runs around the sides. Make note of which terminal is positive and which is negative, either from markings on the outside of the case or from the cell connections. Pull the cells out and cut them away from the connector terminals. Now, hot-melt glue the terminal assembly back into the shell so that the terminals line up where they originally were. Take the 1 ohm, 2 watt resistor and connect it to the positive terminal. Bend the lead so that the body of the resistor hangs in the air and doesn't come in contact with the plastic case. Connect about 6 to 8 inches of wire to the negative terminal, and the same length from the other end of the resistor. Put a hole in the top half of the battery case and run the wires out through it. Finally, connect them to the jack or jig you're using to mate with the HT pack. Be absolutely *certain* to get the polarity right; reversing it will ruin your battery and might even destroy the charger. Just connect + to +, and - to -. Now, close the empty camcorder pack up with a thin film of hot-melt glue around the seam. Be sure to keep the glue thin so the pack will slide onto the charger without impediment. That's it—you've just created your own quick and easy video HT charger!

Using It

To quick-charge your HT battery, first connect it to the jack or jig. Be sure to do this before you snap the other end onto the camcorder charger, in order to avoid causing even a momentary short which the charger may not appreciate. Now, snap the dummy camcorder battery onto the charger. The charge light should come on. If you're charging a standard 600 mAh battery, the charge light should begin to blink (or shut off if you've bypassed the diode) in about 90 minutes, indicating that the battery is fully charged. The battery will be a little warm, just as it would be with the factory quick charger, but it should not be hot.

Some Thoughts

I designed this project around my Sony-type charger. It should work with most charger brands but, if it won't work with yours, the likely cause is the HT pack's protection diode. I tried it with one of those "universal" aftermarket chargers, and the diode prevented it from working, because that unit avoids the use of a starting switch by sensing the presence of battery voltage, which the diode blocks. Also, if you want to use a unit with a "discharge" function, you must bypass the diode for the discharge cycle to work.

The 1 ohm resistor gets fairly hot during the first part of the charge cycle, and that's normal. I used a 2 watt resistor, but you can use a bigger one if you are worried about it. But, be certain *not* to use a wirewound resistor, because its inductance might interfere with the pulse action of the charger. Be sure to use a non-inductive resistor.

Finally, don't try to charge a battery with a rating at or near your charger's output voltage. You can't charge a 12-volt battery on a 10-volt charger!

I hope you find this project useful. I still have my old wall-cube charger, but don't ask me where it is—I think I threw it in a drawer somewhere. Once you start quick-charging, you'll never go back to the old overnight routine again. There's nothing like having your HT back on line only 90 minutes after the battery dies. And the best part is, you didn't have to spend big bucks to do it!

RTTY LOOP

Number 13 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

All in all, one of the most popular features of "RTTY Loop" in the past few years has been the accumulated programs for RTTY, packet, and the like represented by the "RTTY Loop" disk collection. This month, I humbly present to you, my faithful readership, the sixth disk in the collection.

This disk contains six programs which add a wide variety of features and functions.

GRAPHIC PACKET Version 1.61—GP161.ZIP

Graphic Packet is an icon-oriented, mouse-driven terminal program that runs with TNC software such as the WA8DED package, or similar. Mouseless users can access functions through hot keys. Up to 10 channels of communication are available, with mailbox operation as well. Even a small text editor is built into the system.

GP requires an IBM compatible computer with a minimum of 512K RAM, DOS 2.0 or higher, and an EGA or VGA graphics card. A basic version is included for 8088 and higher computers, with a special version optimized for 80286 and above included as well.

LAN-LINK Version 2.20—LL220EXE.ZIP

In the words of the author, LAN-LINK is a Personal Packet Terminal Program for the TNC1, TNC2, KPC-2, and, most of all, a smart multimode digital communications controller for the KAM, MFJ-1278, and the PK-232. LAN-LINK is designed to optimize the configuration of the TNC in each communications mode and to provide some smart terminal features. It takes advantage of the extra features of the PK-232, made by Advanced Electronics Applications Inc. It is designed to allow anyone to use and get the most out of their packet TNC as well as from the PK-232, the MFJ-1278, and the KAM for Morse, ASCII, BAUDOT, AMTOR and packet radio communications without having to keep the manual handy.

LAN-LINK is a sophisticated program. In its basic state it allows you to use the TNC in an optimal manner. It configures the TNC (it types the commands) for you to maximize the communications efficiency in the communications mode of your choice. That means, for example, that when working packet on HF you need to program the TNC parameters to different values than you would use on VHF to make maximum use of the mode. One significant difference is the length of the packet itself: the longer it is, the greater the probability of QRM destroying it. This program will adjust the packet parameters for you.

Since the computer is now involved, other features have been added to simplify operation, and several features have been automated. All these operations are performed using menus and function keys, as documented below. It will take a while to learn how to use this program in a manner which suits you. Read this document and have fun. After all, isn't that one of the purposes of amateur radio?

PACKHACK—PACKHACK.ZIP

Again, I think the author has said it best. PACKHACK is a program used to analyze packet radio activity taking place on a specific radio channel. It identifies and counts packets from each station, and categorizes the packets into frame types. Generally, only "I" frames contain user information. The "RR" frames are Acks, the "UA" frames are Acks for disconnect requests, the "D" frames are disconnect requests, and the REJ frames are Reject, send again requests. See a TNC-II manual for a complete discussion on frame types. With PACKHACK you can see a list of stations on the air, and the number and type of each packet sent by each station. You can see which node is most active and if most of its activity is retries or real information. It is interesting to compare the ratio of I to RR frames for different stations, and hopefully it will be useful, too.

PktWin Version 2.1—PKTWIN21.ZIP

This program is a shareware packet TNC controller program for amateur radio. As such, it requires connection to a TNC or similar via a serial port. It is designed to run under Windows 3.1.

The program has two main windows, a large receive window, and a smaller transmit one. Both are fully scrolling, with buffer sizes from 1K to several hundred kilobytes. It has the facility to both receive and transmit text files, with YAPP transfer for binary files.

RTTY Frequency List—RTTYFREQ.LST

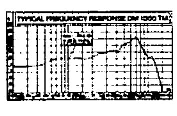
This is a little file I picked up some time ago, which lists various RTTY signals heard on the HF bands. It is a bit dated, and many of the stations may have moved on, but it at least gives some potential hot spots to listen for, which many of you have asked for. As an aside, I am more than willing to update this list with recent findings, as information arrives at this QTH.

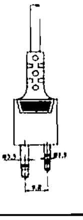
TERM Version 2.0—TERM2.ZIP

TERM is a simple interrupt-driven communications program written in assembly language. It supports up to 115.2 Kbps. It will detect a 16550A UART chip and will use the FIFO buffers if one is found. It does not offer any binary file transfer protocols. It will capture ASCII to a disk file or to a printer. Version 2.0 will now upload ASCII files. It also will support any number of rows on the screen, but the screen mode must be set prior to executing TERM. The commands are patterned after those of Procomm Plus. Version 2.0 also accepts a command line option (/M) that forces monochrome display colors. The author uses TERM for packet radio and for accessing host computers at work. It is great for any communications that do not require binary file transfers. It is small, fast and easy to use.

Well, there you have it. Six programs that run from simple information, to a simple terminal, to a complete graphics packet package. And all this can be yours by sending me a 3.5" disk, a self-addressed, stamped disk mailer to return the disk to you, and $2 in US funds, to the address at the top of this column. The other five disks remain available as well, and a listing of all programs available is on the disk. Alternatively, just a printed listing can be yours by sending me a self-addressed, stamped envelope, requesting the latest "RTTY Loop" disk collection list.

I look forward to your comments and questions, and am busily looking into some of your recent questions for future "RTTY Loop" columns. Keep them coming to me by SnailMail at the above address, or Email on CompuServe (ppn 75036,2501), Delphi (MarcWA3AJR), America Online (MarcWA3AJR), or Internet (MarcWA3AJR@aol.com).





CARR'S CORNER

Number 14 on your Feedback card

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Simple Band-Pass Filters for Receiver Projects

One approach to designing simple radio receivers is to use a broadband front end. Although at one time the front ends of radio receivers were tuned to a specific frequency, for the past two decades or so a broadband approach has been popular. The need for broadband tuning became apparent to me when I was working on some direct conversion receiver (DCR) designs. The DCR is similar to the superheterodyne (Figure 1), except that the local oscillator (LO) operates on or quite near the desired RF frequency.

For example, if you wanted to tune a DCR to receive a 7050 kHz CW signal, and wanted about a 1000 Hz beat note in your earphones, then the local oscillator would be set to either 7049 or 7051 kHz. When the local oscillator signal and the 7050 kHz RF signal is heterodyned together, the result is the 1000 Hz difference signal. An audio low-pass filter, or a transformer that acts inherently as a "low-pass filter" when the other signals in the passband are RF, at the output will select the difference signal over the LO and RF components that survive the heterodyning process.

Most DCRs use simple double-balanced mixers (DBM) of the diode variety, or Wilson Transconductance Cells (of the NE-602 IC variety) as the frequency converter. In both cases, strong signals appearing at the input can wipe out the effectiveness of the mixer. In addition, there are a number of other ways that even relatively weak out-of-band signals can appear in the output of the DCR. Although specific frequency tuning is used, it adds one tuning control. The minimalist design approach requires a bandpass filter at the front end that admits only those signals that are desired.

Figure 2 shows the circuit to a bandpass filter made by cascading low-pass and high-pass filter sections. In practice, some isolation may be required between the LPF and HPF sections, unless there is a relatively wide separation between the cut-off frequencies. Each section is a five-element design with 0.1 dB ripple (more or less), as defined in recent editions of *The ARRL Radio Amateur's Handbook*. The values for the components are found as follows:

L1 = 9.126/F
L2 = 15.72/F
L3 = 9.126/F
L4 = 5.803/F
L5 = 5.803/F
C1 = 4365/F
C2 = 4365/F
C3 = 2776/F
C4 = 1662/F
C5 = 2776/F

where F is the frequency in megahertz (MHz), the inductances are in microhenrys (µH) and the capacitances are in picofarads (pF).

The printed circuit board (PCB) pattern in Figure 3 is designed for miniature 7mm and 10mm coils of the sort made by Toko, and sold through Digi-Key (P.O. Box 677, Thief River Falls MN 56701-0677; 1-800-344-4539). However, if a toroidal core coil is used, which you can home-brew, then use the two outer pins on the three-pin side of the coils' foil pattern to make the connection (that corresponds to the internal wiring of the Toko coils). If you want a copy of the PCB, they are available for $4.25 plus $1.50 S & H per order from FAR Circuits (18N640 Field Court Dundee IL 60118).

Figure 4 shows one version of the circuit intended for use at the front end of a high performance AM broadcast band receiver that I am working on. The filter has -3 dB cutoff points of 500 kHz and 2,000 kHz with the values shown. The completed filter, using the PCB of Figure 3 and the values shown in Figure 4, is shown in Photo A. The shielding is made from strips of 1" brass sheet metal strips. These strips are typically available in hobby shops that deal with model builders, as well as "lapidary" and amateur jewelry makers' shops. The sides of the box were bent square, then soldered. The corners were joined with soldered bits of brass right angle stock (available from the same sources).

By the way, if you wish to experiment with direct conversion receivers, you might want to look into the NE-602 IC and the Mini-Circuits passive double balanced mixers. Ocean State Electronics (P.O. Box 1458, Westerly RI 02891; 401-596-3080) lists one of the Mini-Circuits DBMs in their catalog. They also sell the MAR-x series of Mini-Circuits monolithic microwave integrated circuits (MMICs). Write for their 1994-95 catalog—it's interesting for the ham builder.

If there is enough interest, then I'll cover the basic direct conversion receiver designs in this column in the near future.

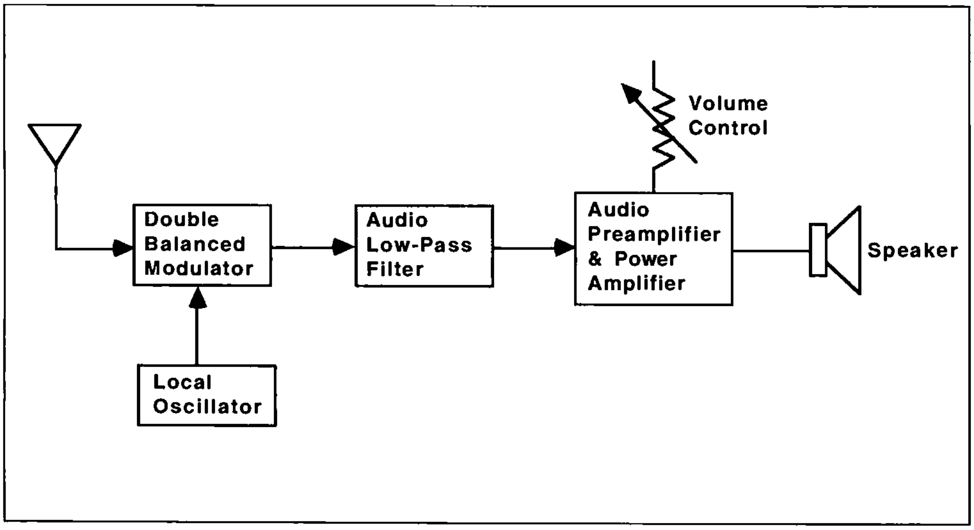

Figure 1. Block diagram of a direct conversion receiver.

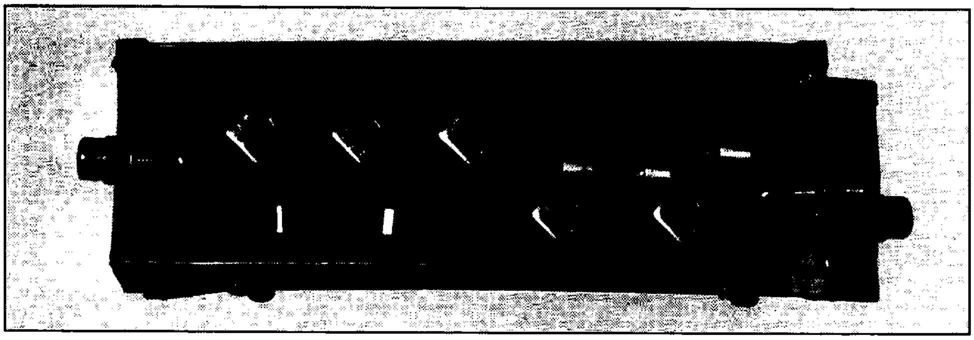

Photo A. Actual as-built filter circuit.

Book Note

Recently one of my publishers, Hightext Publications (P.O. Box 1489, Solana Beach CA 92075; 1-800-247-6553) sent me a newly-released book that I found thrilling. *Modeling Engineering Systems* by Jack W. Lewis is a real must for anyone interested in writing PC-based software models of electrical circuits and mechanical devices. This text grew out of a course the author took at MIT, as well as his own professional experience. Expecting to find this topic a real snooze, I was pleasantly surprised for Lewis' book makes the once-arcane art of modeling accessible to anyone with a basic math background.

Although at least introductory calculus is needed to get the most out of this book, calculus is not strictly necessary, as the clear, well-thought-out writing style makes complex concepts easily understood.

Lewis starts off by teaching us something about the engineering design process ". . . in a nutshell," as he puts it. Although the book is on the subject of creating PC-based models, Lewis cleverly uses electrical circuits and mechanical thingees to illustrate the different approaches . . . a fact that is immensely important to those of us who have some knowledge of technology but are not yet well-versed in the mysteries of writing models.

I tried very hard to find something negative to say about *Modeling Engineering Systems* because, as my own experience for the past 25 years indi-

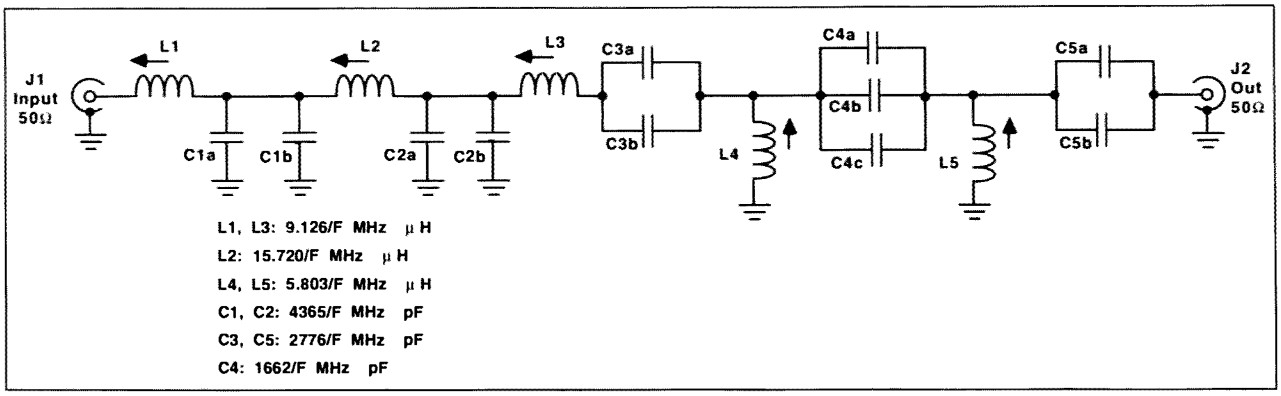

Figure 2. Bandpass filter circuit.

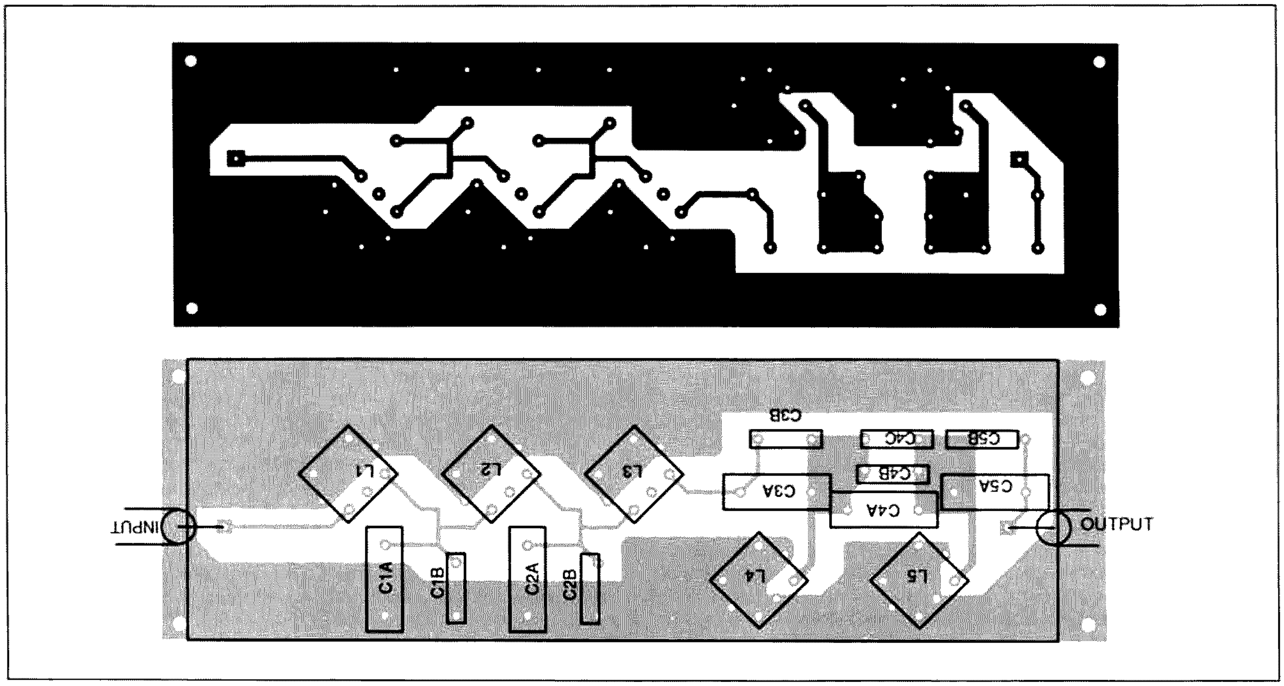

Figure 3. PCB pattern and parts overlay.

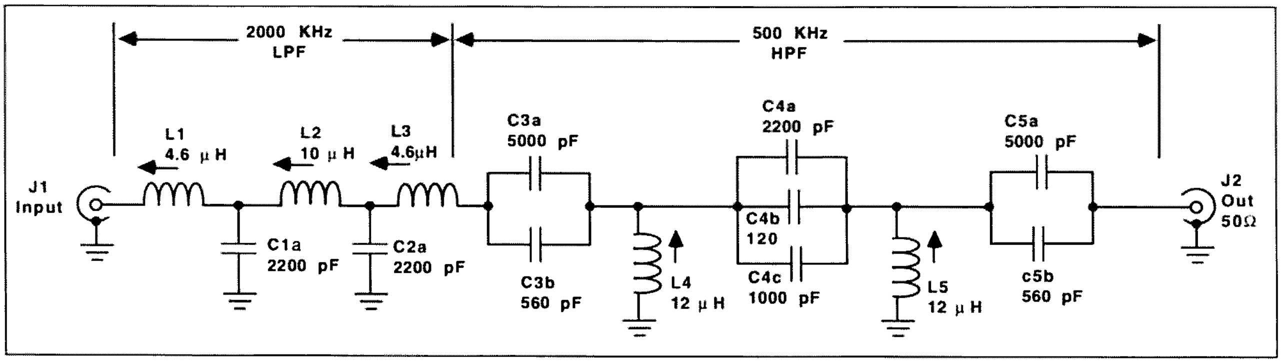

Figure 4. AM BCB version of the filter.

cates, reviewers are supposed to maintain their "tough image" by castigating the ancestry of authors, or tearing down their ego or somehow vilifying their work. But that would be the jealousy of a fellow author speaking, not my actual judgement. I really couldn't find anything missing or wrong in Lewis' book, try as I might.

I can predict one thing about Modeling Engineering Systems, however: Forward-looking engineering and electronic technology schools will adopt Lewis' book and recommend it to their students. Backward schools, where the professors are less like practicing engineers and more like sedentary slugs teaching running, will take note of three facts: 1) it is low-priced ($19.95 not $99.95); 2) it is an easy read; and 3) it is a large paperback rather than clothbound . . . and thereby reject it. After all, they will unreason, why give students an easy-to-read book, that makes a difficult subject damn near easy, and that costs less than dinner out?

Seriously, though, if you have any interest in computer modeling of circuits (or any engineering system), then give Jack Lewis' book, *Modeling Engineering Systems*, a close read.

HAM HELP

Number 15 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

NEEDED: Service manual/schematic for a SIGMA Model AF-250L AM/FM Analyzer. I will gladly pay the photocopy and postage. Thanks. *Kenny Hudson K5QLP, 1021 8th St., Bay City TX 77414.*

Where can I purchase the Operating Manual for a SWAN HF700S? Please reply via Fax to *(409) 746-7370. Raymond Barnes KC5AWE.*

WANTED: Manual for LAFAYETTE Six-band Communications Receiver BCR-101. I will pay for copy and postage costs. Thanks. *Eugene Taylor KB6KRI, 12016 Willard St., North Hollywood CA 91605. Tel. (818) 767-2972.*

I am in need of any schematic, manual or specifications on a 1986 microwave downconverter manufactured by Microelectronics Technology Inc., Model CL-2011. It was used for INMARSAT (approx. 1600 MHz). I want to use it for GOES reception (1691 MHz). I will pay any costs. *Jim Kocsis WA9PYH, 2217 Hidden Oaks Ct., South Bend IN 46628.*

I am trying to locate Earl L. Eggers HR1EZ, or anyone that may be able to help me learn about the time he spent in Honduras. Earl was active in Honduras in the late 50's. *Dr. Michael K. Gauthier K6ICS, 9550 Gallatin Rd., Downey CA 90240-2538.*

I would like to correspond with Amateur Radio and CB Radio operators. Please write to *Estelle Casaldi, AAAA, 3343 Webster Ave., Pittsburgh PA 15219.*

I have several old Model 33 printers and a Model 40 teletype unit with a built-in printer. These are free to any organization or person that can use them. Contact me evenings at *(815) 786-6860. Mike O'Day.*

DEALER DIRECTORY

Number 16 on your Feedback card

QRP

Number 17 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
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Massillon OH 44646

Several months ago, I described a small QSK module for the Howes transceiver. This circuit worked so well that I decided to use it in another rig. However, I did not want to build another one on perfboard. That method is fine if you only need one or two copies. So, this month, here is the PC board and overlay for the QSK module.

Several items have been changed since the circuit came out. First, the switching relay is now a sealed multipole jobbie that switches very fast. It's available from Digi-Key electronics at a reasonable price. Also, there are several holes in the PC board for extra connections to the +12 volts and ground returns. No more running wires back to an undersized terminal strip. A reverse polarity protection diode and fuse has been added as well. Everything mounts on one PC board, with plenty of room for new builders to move around with. The PC board is available from FAR Circuits (see the Parts List).

Aside from the relay and the two trimmer pots, nothing is especially critical. You should use your junk box for this project. You can assemble only the sections you need, without worrying about screwing something up. If you don't need the sidetone, then don't install those parts. Likewise, if you don't need the keying relay. The reed relay for the transmitter is an off-the-shelf part from your local Radio Shack store. Any suitable reed relay will work, provided you can get it to fit on the PC board.

I'll refer you to the original article for the ins and outs of the circuit. Most of the circuit is very simple stuff to figure out. Troubleshooting should be limited to taking voltage reading at the pins of the LM324.

Now, the next time you need a QSK board, you have a cheap, easy and quick option.

Junk-Box Fillers

In the older days of ham radio, you could set up a complete station with a couple of burned-out TVs. Since things have gone totally solid-state, I've found used TVs to be a rather limited source of building material. However, I received this letter from Neil Iverson N7NI. The following is how Neil gets most of his parts for his QRP projects.

"A local TV repair shop sets their unrepairable TVs outside by the side of the shop, and they welcome me to pick parts out of them. Note that many of the tuners now being tossed out have absolutely superb dual-gate MOSFETS in both the VHF and UHF sections, along with some switching diodes and varicaps, too. I bring home the whole tuner assembly and carefully lift out the parts. These tuners are varactor-tuned and so there is no shaft or knob sticking out from them.

"Some of the IF strips also use dual-gate MOSFETS at 41 MHz. They will work great in our QRP projects.

"Another place to look is at the CRT connector. There is usually a small circuit board there with three video output transistors on it. Sometimes those three transistors are suitable for power output RF finals in a QRP transmitter. You can check their specifications in the NTE or SK replacement guides by seeing what their replacements will do. Here are some common types I've found in junk box TVs:

Type	Watts	Ic	VcBo	Hfe	FT (MHz)
2SC1124	10	1A	140	160	120
2SC1226	10	3A	50	120	150
2SC1678	10	3A	65	40	150
2SC1957	0.75	1A	75	90	250
2SC1959	0.6	4A	70	120	200
2SC1973	12	3A	65	80	300
NSD U01	6.25	1A	90	120	200
039-I	—	1A	90	90	150

"Some of these video transistors have breakdown ratings of 300 volts, and pretty good high frequency response. They're well worth saving out and keeping for future projects.

"Another part I watch for are the damper diodes. Those have ratings of 600 volts and higher, usually 1 amp of current, and they switch within 200 nanoseconds. There are also lots of small inductors and beads that are always useful."

An HW-8 Modification

Here's a new modification for the HW-8 rig. It's by Robert Walter N1EBA, and came to me via CompuServe. I hope you enjoy this modification. Robert writes the following:

"Last year I bought a used HW-8 and after using it for some time, particularly on the 80 meter band, I became annoyed at the constant adjusting of the RF gain control, due to strong signals. If the signal was too strong one would have to turn the RF gain control down. If the signal was too weak, the RF gain control had to be turned up. This was annoying because in the real world radio signal strengths do not remain constant. There was never an ideal position for this control. With the RF gain control in its most clockwise position on the HW-8 there is a tendency for the RF amp to overload itself or the product detector and audio circuits. As a result, distortion is heard. I decided to investigate why this was happening.

"After looking at the schematic of the HW-8, I discovered that the HW-8 does not have an automatic gain control (AGC) circuit. I decided to look into the possibilities of installing my own AGC circuit into my HW-8 and came up with the circuit shown.

"The circuit applies a negative voltage derived from the audio output to the gate of Q1 of the HW-8. The half-wave rectifier D1 rectifies the audio to produce unfiltered DC taken from pin 6 of the audio gain control. This voltage is then filtered by C1 to produce a negative DC voltage. Current is then passed through R2. C2 is then charged and discharged by the RC constant created by C2 and R3. This RC constant determines how fast the AGC action will be. D2 ensures that the voltage presented to the gate of Q1 never goes positive more than 0.6 volts. S1 is used to bypass the AGC circuit altogether, if you want the option of no AGC. I found that the AGC circuit may not be necessary on higher frequency bands. Most of the parts values were determined by what I had available at the time. Other values may be used to optimize the circuit for personal preferences. In addition, a variable resistance may be used at R3 to change the RC constant, thereby changing the action of the AGC (faster or slower). Other configurations are possible as well. I chose to keep my circuit as simple as possible. I also increased the receiver sensitivity slightly by replacing Q1 with a 2N4416. A 2N4416 has a higher transconductance than the MPF105. Changing Q1 is optional.

"I mounted all components on a 1 x 2 piece of perfboard and glued the board with silicone sealer to the interior of the chassis. To connect the circuit to the HW-8, disconnect the ground side of R5 in the HW-8 and connect the output of the AGC circuit to R5. Connect the input of the AGC circuit to pin 6 of the AF gain control in the HW-8. I attached S1 through the extra holes of the connector on the rear of the HW-8 since I didn't want to alter the cabinet. Connect the ground of the AGC circuit to the chassis of the HW-8.

"I found having an AGC circuit on my HW-8 handy when working signals on the 80 meter band. It can be tricky at times to copy code with signals varying all over the place, especially if one cannot concentrate, like myself, because of other distractions. This circuit will be beneficial where an extra hand may not be available." From Robert Walter N1EBA, Waterford, Connecticut, Prodigy SDMT67A, CompuServe 72614,3270.

HW-9 Modification

Have you picked up an HW-9 lately? Can't seem to figure out why it seems to work great on some bands, but plays dead on another? Well, the trick may be as simple as a mistuned stage. After checking out the switching diodes for each bank oscillator, be sure you have the slugs in the proper

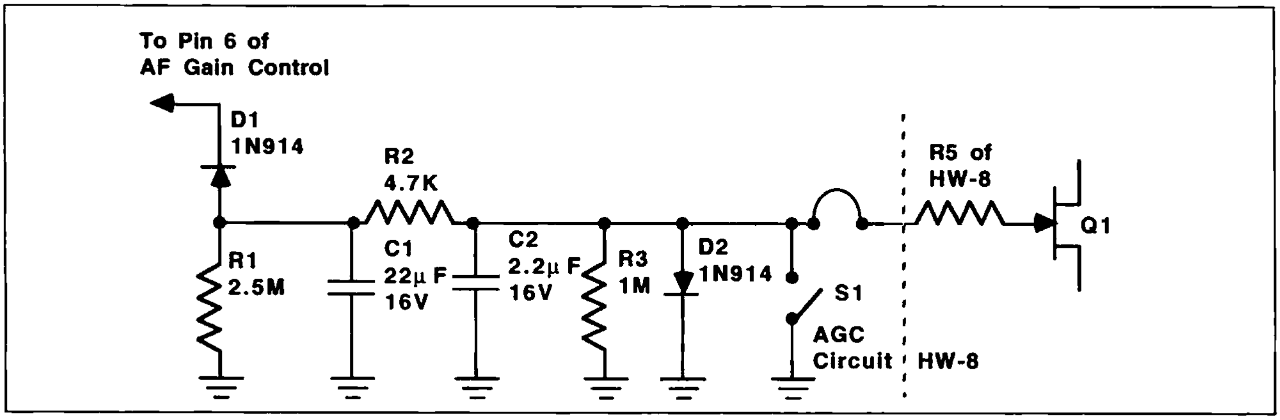

Figure 1. Schematic diagram for the QSK Module.

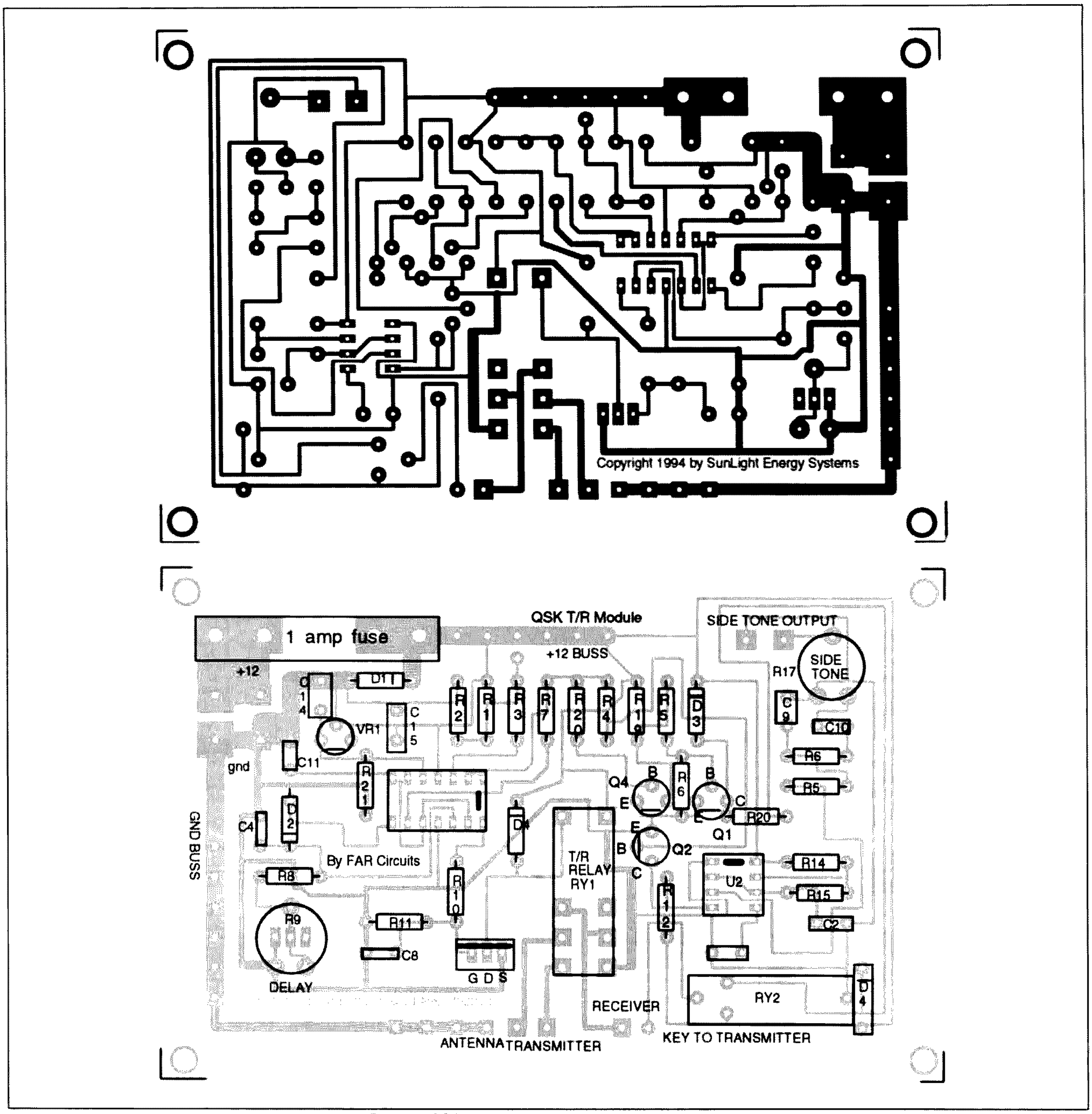

Figure 2. PC board pattern and parts placement overlay.

place as per the manual. You can have more than one peak in some of the coils. This false peak will prevent the rig from operating on one or more bands. Also, while you're checking out the cans, be sure you have the IF coils adjusted properly. The HW-9's receiver can easily go into oscillation if the IF coils are misaligned. A lot of *white* noise in the receiver is a dead giveaway that something is out of whack.

Modifications like these are available from the HW-8 *Handbook*. At $11 a copy, I'll ship you out one and even throw in the shipping cost. My address is at the beginning of this column.

The QRP ARCI

As of this April, I've taken over the job of membership person. If you would like to join the QRP ARCI, send $12 for new membership. If you would like to renew your old membership, the cost is $10. If you have not been active on the HF frequencies in the past, but were a member way back when, you still keep your old QRP number. If giant Iranian goat-eating cockroaches got the best of your membership certificate, for $2 you can get a replacement from me. If you just want some more information about QRP ARCI, I'm the guy for that, too. The PR package is $2 which includes a copy of *The Quarterly*.

Parts List

R17-R19	470k trimmer
VR1	78LO8 regulator
Q3	IRF511 or equal power MOSFET
Q1-Q2, Q4	2N2222 or equal NPN transistor
U1	LM324 op amplifier
U2	NE555 timer
RY1	Reed relay (Radio Shack)
RY2	Omron G2R-24 sealed relay (Digi-Key # Z747-ND)

A drilled and etched printed circuit board is available for $7.75 plus $1.50 S&H per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Note: C3 is not on the PCB, but is part of the circuit as shown in the schematic. The rest of the parts are garden variety resistors and diodes. Feel free to play with the values.

Number 18 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

NASA Follow-Up Activities

At the end of every term I have the children in my sixth, seventh, and eighth-grade ham radio classes summarize the units that they enjoyed most. With very few exceptions, the children pick the unit on "Space Travel and Communications" amongst their best-loved experiences in class. Speaking with astronauts on the radio, following the SAREX (Shuttle Amateur Radio Experiment) program, having a chance to view a shuttle launch in person, and having your personal questions answered by a human being who has been in space, are obviously glamorous and exciting experiences for youngsters. Because of the motivation generated by these unique adventures, the kids are very interested in all the follow-up activities as well. Always remember that as an instructor or teacher in a classroom, the single most important thing you do is to motivate everyone so that they will be receptive to learning.

The following activities are suggested by the NASA Resource Centers for Teachers. I incorporated them into my unit on space, and the kids really loved doing them.

One of the biggest fascinations the children have is with the spacesuit. Shuttle suits are worn only when it's time to venture out of the spacecraft. At other times, the crew wears comfortable shirts and slacks, or coveralls. Fully assembled, the shuttle EMU (Extravehicular Mobility Unit) becomes a nearly complete short-term spacecraft for one person. It provides pressure, thermal and micrometeoroid protection, oxygen, cooling water, drinking water, food, waste collection (including carbon dioxide removal), electrical power, and communications.

The EMU lacks only maneuvering capability, but this can be added by fitting a gas-jet-propelled Manned Maneuvering Unit (MMU) over the EMU's primary life-support system. On earth, the suit and all its parts, fully assembled but without the MMU, weighs about 113 kilograms (about 248 pounds). Orbiting above earth, it feels as if it is weightless. It does, however, retain its mass in space, which is felt as resistance to a change in motion.

Photo A. Actual tools used by astronaut Jay Apt N5QWL on his spacewalk in April 1991.

Activity One: Spacesuit Mobility-Bending Under Pressure

Objective: To compare the ability of inflated balloons to bend in an analogy to the arm of a spacesuit.

Materials: Two long balloons, three plastic bracelets, metal craft rings or thick rubber bands.

Procedure: Step 1. Inflate one balloon fully and tie it.

Step 2. Inflate the second balloon, but while it is inflating, slide the bracelets, craft rings, or rubber bands over the balloon so that the balloon looks like sausage links.

Step 3. Ask the students to com-

pare the "bendability" of the two balloons.

Discussion: Maintaining proper pressure inside a spacesuit is essential to astronauts' survival. A lack of pressure is fatal. Pressure, however, produces its own problems. An inflated spacesuit can be very difficult to bend. In essence, a spacesuit is a balloon with the astronaut inside. The rubber of a balloon keeps in air. But as pressure inside the balloon builds up, the balloon's walls become stiff and hard to bend. It would be impossible for an astronaut to function effectively in a stiff suit.

Spacesuit designers have learned that strategically placed breaking points (the rings in this demonstration) at appropriate points outside the pressure bladder (the balloon-like layer inside a spacesuit) makes the suit become more bendable. The breaking points help form joints that bend more easily than unjointed materials. The same thing happens with the balloon and rings. Built-in joints, like ribs on vacuum cleaner hoses, also promote easier bending than unjointed material.

Activity Two: Space Tools

Objective: To experience the difficulty of using tools that astronauts encounter on spacewalks.

Materials Needed: Several sets of thick, insulated ski gloves or heavy rubber work gloves. Miscellaneous tools and items such as needle-nosed pliers, socket wrenches, small, machine screws and nuts, lamp cord and plug, Tinker Toys, or Legos, paper and pencil.

Procedure: Step 1. Instruct students to put on the gloves and begin working with the tools and other items. The gloves represent the stiff, bulky gloves astronauts wear while on spacewalks.

Step 2. Have your students compare the difficulty of doing a particular task such as wiring a lamp cord to a plug, assembling a structure out of construction toys, or writing a message, with and without gloves.

Step 3. Ask your students to try to design tools that could help them do their work in space if they were repairing a satellite.

Discussion: Spacesuit gloves can be stiff and hard to work in. The gloves worn by *Apollo* astronauts on the moon caused much finger fatigue and abrasion during long moonwalks. Designers have placed special emphasis on making pressurized gloves more flexible and easy to wear. When inflated, the gloves become stiff just like an inflated balloon. Designers have employed finger joints, metal bands, and lacings to make gloves easier to use.

Another effort is underway to create design tools for use with spacesuit gloves. This activity illustrates the problem of manipulating objects and encourages students to custom-design tools to help spacewalkers do their jobs.

The NASA follow-up activities can be a fun, meaningful way for kids to learn scientific principles and to become interested in the space program.

Photo B. The spacesuit is a constant source of fascination to kids. On a visit to the Johnson Space Center, Carole gathers NASA Resource Center materials to use in class.

Number 19 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., KØOV
P.O. Box 2508
Fullerton CA 92633

Navigation and Networking via Packet

There is an unusual signal on your favorite round-table frequency or the input to your local repeater. Where is it coming from? You rotate your directional antenna and the peak on your S-meter (or the null, depending on antenna type) tells you that the direction to the signal is due south (a 180-degree true bearing).

You call a ham friend a few miles to the east and ask him to listen for the signal. A few minutes later, he calls back to say that he hears it best with his antenna pointed at 300 degrees true. You draw both of the lines of bearing on a street map and discover that they intersect in an industrial area on the west side of town.

The procedure you have just performed is called triangulation. The term comes from surveying, where land is mapped by trigonometry. Terrain is divided into triangles and the angles within them are measured.

Signal triangulation with practical antennas doesn't provide pinpoint accuracy, of course. If you and your friend want to identify the exact location of the emitter, you need to take your directional antennas to locations near your bearing intersection and repeat the triangulation process as you home in.

Where Am I?

Most hams envision the above scenario when hearing the term "radio direction finding" (RDF). You know where you are, and your mission is to find the unknown location of the transmitter. But you can use the same method of direction determination and trigonometry in reverse when you know the locations of two transmitters, but you don't know where you are.

Throughout the history of RDF, which began in the first world war, its usefulness as an aid to navigation has been just as important as its ability to find hidden signals. Back then, ships steered their courses based on information from their directional antennas and shore beacon transmitters. At the same time, these stations listened for signals from enemy ships and triangulated them to determine their movements. Legend has it that the Battle of Jutland, a decisive naval conflict, was launched when British RDF stations detected movement of the German fleet.

In World War II, FCC's Radio Intelligence Division tracked enemy signals from distant continents, while our aircraft used friendly radio signals to determine their own positions. In the 1950s, our government feared that hams' signals would be both homing and navigation aids to Soviet bombers if they staged a surprise attack on the USA. So every amateur radio station was required to have a Conelrad monitor in constant operation during on-air periods. (I think mine is in the garage somewhere.)

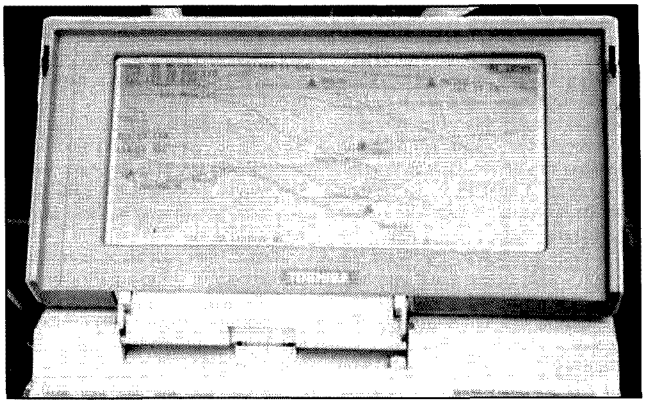

Photo A. With a packet radio terminal and a portable computer running APRS software, mobile transmitter hunters can triangulate bearings posted by other base and mobile stations. Several methods to automate the bearing transmission process are now in the works.

Accuracy and user-friendliness of radionavigation systems have steadily improved over the years. Long Range Navigation (LORAN) replaced long-wave direction finding on ships. VHF Directional Range (VAR), Omnidirectional Radio Range (VOR), and Distance Measuring Equipment (DME) on aircraft replaced RDFing of radio range and AM broadcast stations.

Now the NAVSTAR Global Positioning System is in full operation. It's the navigation system of the nineties, offering accuracy to within 100 meters and continuous automatic position computations. This level of location accuracy is impossible using the old reverse-triangulation method. Errors of a fraction of a degree in bearing-taking can affect triangulated positions by many miles. What's more, accurate directional antennas cannot fit into today's HT-sized navigation units.

Instead of relying on directional bearings to reference transmitters, GPS measures the difference in propagation time of the pulsed signals from them. The difference in time gives the relative difference in distance from each reference, which is enough data for computation of latitude and longitude. This technique is called multilateration. It was first used in LORAN and DME for surface-only positioning. The orbiting satellite references of the GPS system allow determination of your altitude, as well.

It takes knowledge of the relative distance to three known points, not

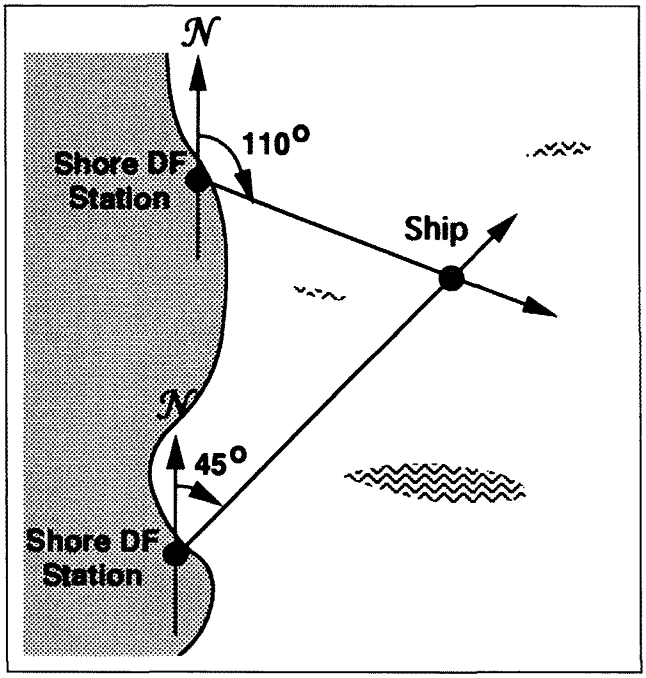

Figure 1. In the earliest days of RDF, navies plotted the location of enemy and friendly ships by triangulating the bearings of their radio signals.

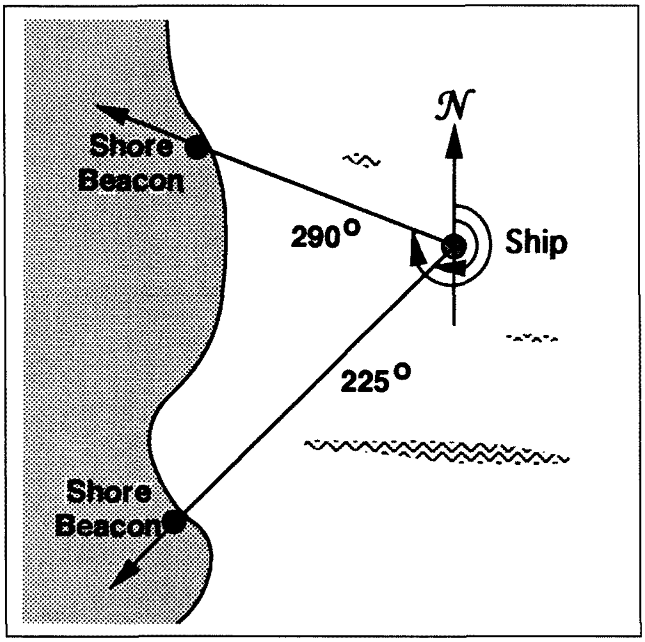

Figure 2. Triangulation in reverse was the first method of radionavigation. Ships found their positions using transmissions from known shore stations.

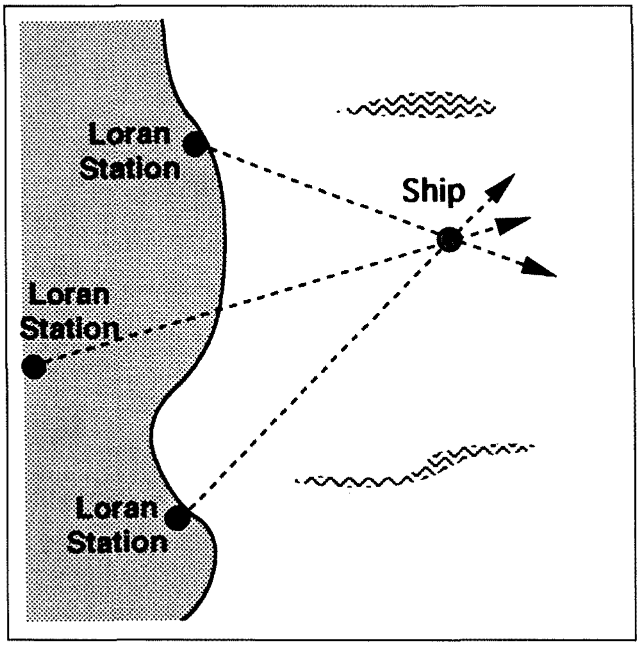

Figure 3. The LORAN system determines a vessel's position by the difference in arrival time of coded pulsed signals from three known land stations, using multilateration. GPS uses satellites to give worldwide coverage and add altitude measurement capability.

two, to fix yourself on a map using satellite multilateration when you are on the ground. If you are airborne, a four-satellite fix is needed to find your position and altitude. Details of the GPS system and available GPS receivers have been published widely, so there is no need to give the whole story here. For a good GPS overview, pull out your July 1994 issue of *73* and read the articles by WA4BLC and WB6NOA, beginning on page 10.

Mapping the Fleet

In addition to knowing your own coordinates, it is often just as important to track the positions of other moving things. For example, a police dispatcher who knows the exact location and status of each squad car can rapidly determine which one is able to respond most quickly to an emergency call. So why not put a GPS unit in each cruiser, hooked to the officer's radio such that it sends a burst of digital data with each transmission or upon command, giving the unit's position to the dispatcher's computer? A few commercial companies now offer tracking systems like this to governmental agencies, perhaps one in your town.

It is possible that ham operators were first with the idea of building a network of moving position-squawking transmitters. At least one ham has been experimenting with the concept for over 12 years. He is Bob Bruninga WB4APR, whose comprehensive shareware tracking program is called Automatic Packet Reporting System (APRS).

In its simplest form, APRS is just a mapping program. All stations in an APRS network transmit their exact locations at regular intervals. Fixed stations beacon occasionally, while moving stations beacon more often, depending on their speed. APRS-equipped stations receive the packets and display all station locations on a map of appropriate scale. Stations can send additional information, such as course, speed, weather, and RDF bearings, for processing by APRS.

"As an early packet radio user, I was involved in putting up digipeaters and building the network around here," says Bob. "The graphical representation of net stations was always the question. The early maps of digis, nodes, and BBSs were manually drawn and always out-of-date.

"Once I saw GPS gear coming out," WB4APR continues, "I had a reason to sit down and write a program to automatically display station locations, even if they are moving. The biggest hump was deciding what I was going to use for on-screen maps. I talked with people who worked at the geological survey and people who were involved with software, to see if anyone could identify a commercial program that drew maps, but also gave you, as a programmer, a hook to use in your application.

"After three or four years, I got tired of waiting for cheap commercial maps and developed my own strategy. The beauty of it is that it doesn't belong to anybody else. The maps that we hams draw, we own. We don't have to pay royalties to anyone. The commercial digital map companies not only wanted royalties for the data, but also wanted royalties for every copy of every map. That would just not work in the ham community. APRS mapping is done in a way such that anyone can use a text editor to create maps."

For a network of marathon checkpoints on 2 meter packet, a street map or a special course map is used by all APRS stations. For a wide area operation on HF, such as a boat race, a map of all or part of the USA is just right. Since all beaconed coordinates are in degrees and minutes of latitude and longitude, it is not required that every station's display use the same map scale.

Coordinates of moving stations are most easily captured by connecting the station's APRS computer to a GPS receiver's NMEA-0183 data output port. If no GPS unit is available, the user can enter coordinates on the computer keyboard. An object to be tracked does not have to have a computer hooked to the transmitter. To automatically beacon to the network, all that is required is a packet node controller, transmitter, and GPS receiver. PacComm Packet Radio Systems sells integrated TNC/GPS sets, ready to connect to your transceiver.

To demonstrate APRS tracking, WB4APR and other members of the US Naval Academy Radio Club followed the progress of the game ball for the 1992 Army/Navy game on its traditional 128-mile relay run from Annapolis to Philadelphia. All the beaconing equipment fit inside the helmet of the midshipman carrying the ball. The chase vehicle contained a digipeater to relay data to a network of APRS-equipped packet stations displaying the ball's progress to spectators and officials along the route.

Unlike other packet networks such as DX Packet Cluster, where all stations maintain a connection with the host, all APRS reporting is done with unconnected information (UI) frames. An unlimited number of stations can contribute information to the network simply by transmitting the data. If course and speed information for an object is sent along with the time of observation, APRS will dead reckon the predicted position of the object thereafter, upon command.

Bob and others have been industrious map-makers. Much of the world is now digitized. In addition to world and USA maps, there are regional maps, state maps, local street maps, and aviation sectional maps. As a result, you will need a fast modem to download all APRS files. It takes a high-density diskette to hold them in compressed form. After unzipping, the complete program, maps and sample/demo files require about 2 MB of hard drive space.

WB4APR's program supports CGA, VGA and EGA graphics and runs in color on all popular PC, XT, and AT computers. That's great for the well-equipped shack, but you don't need an expensive machine to get going. The latest APRS505E.EXE file is only 280K, and maps are less than 20K each. For my mobile experiments (Photo A), I use a rudimentary Toshiba T1100+ laptop, which has an 8086 processor, 640 KB memory, and one working 720K floppy drive. It's slower and the number of available maps is much smaller, but it is fine for portable

APRS Resources in this Article

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Glen Burnie MD 21060

Keith Sproul WU2Z
698 Magnolia Rd.
North Brunswick NJ 08902

PacComm Packet Radio Systems, Inc.
4413 N. Hesperides Street
Tampa FL 33614
(813) 874-2980

Annapolis BBS: (410) 280-2503

Other BBS APRS Sources:
(614) 443-4249 Ohio
(407) 575-9680 Florida
(703) 255-2172 Virginia
(602) 938-7528 Arizona
(415) 359-6985 No. California
(310) 541-2503 So. California

Packet Addresses for non-business messages:
WB4APR@WB3V.MD.USA
WU2Z@KB4CYC.NJ.USA
KØOV@WB6YMH.#SOCA.CA.USA

APRS Frequencies:

HF (kHz LSB)	VHF (MHz FM)
7085.6	145.79
10151.5	145.79
14098.0	147.345

use in public service and RDF events.

I doubt that any software engineer is more dedicated to optimizing and improving his product than WB4APR. In the six months I have been investigating APRS, Bob has put out many revisions, each with significant improvements over the ones before. The program keeps getting new features and becomes easier to use.

An APRS version for Macintosh fans is also coming onto the scene. Author Keith Sproul WU2Z is trying to make his product compatible with Bob's PC version in terms of maps and hardware interfaces, while exploiting the special graphics capabilities of color Macs. Now in beta testing, his Version 1 program should be released about the time you read this. It runs on almost any Mac, except SE or Plus, if it has 6 MB or more memory and System 7.

Stay Tuned

APRS is ideal for hams who want to keep track of multiple moving objects in near real-time. But if that were its only use, it would be of only passing interest to hams who hunt hidden signals for sport and for volunteer enforcement. The big attraction of APRS for T-hunters is its ability to network RDF teams, display all their bearings on each team's screen, and perform automatic triangulation on its built-in maps.

An APRS/RDF interface circuit for automatic bearing transmissions is still in the bug-squashing stage, but it appears to be only a month or two away from publication. Meanwhile, you can try out the basic APRS program and eavesdrop on APRS activities locally and nationally by hooking it to your packet TNC.

Bob posts his latest APRS version on the Annapolis BBS. Other BBSs around the country have recent versions, as do online services such as CompuServe's HamNet. Older versions do not have all the latest features, but they are fine for viewing APRS activities in your area.

APRS diskettes are showing up at ham conventions and swap meets. Be sure to look for the latest version. If you can't easily download APRS or find it locally, Bob will send you a disk copy if you include $5 dollars for a high density disk or $10 for two double density disks along with your registration fee.

Program registration costs $19, which is quite reasonable, considering its versatility. One registration is good for all versions. Most features are functional even if you don't register, including the TNC interface, so you can give it a good test drive. Unregistered users cannot save their current configuration (startup map, location, and digipeater path) and must re-enter upon each startup.

When you register, you will receive a unique validation number for use with your own callsign. Enter both and the program enables the writing of configuration files. Additional registration and validation codes are required for special port operations such as the automatic interfaces to GPS receivers and RDF sets. If you aren't registered, you can enter your GPS coordinates and DF bearings from the keyboard. If you don't know your exact latitude/longitude, move the cursor on the map to your location. APRS will determine your coordinates and enter them.

There is too much power and versatility in APRS to cover in a single article. As it is, I'm fighting the urge to add more paragraphs, each starting with "But wait, there's more!" Watch for additional APRS *information in* upcoming "Homing In" installments, including comparisons of the PC and Mac versions. You will also see how APRS can be used to form an automatic RDF network of fixed and mobile stations. You will learn how to tie your RDF equipment, computer, GPS, and packet gear together for APRS.

PACKET & COMPUTERS

Digital Amateur Radio

Jeffrey Sloman N1EWO
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This column is not called "Packet & Computers" by accident. When I first started writing for *73*, it was decided to make this column cover computers themselves as well as their ham radio use. Well, I haven't taken the time to do that yet, so I am going to start this month as a break from our JNOS discussions. (Those of you following the JNOS series, there will be more.)

Choosing a Computer for Your Shack

Let's take a look at what things to consider when buying a computer to use for ham radio. We'll take a look at two paths—cheap, and good.

First, cheap: Many of us work on limited budgets when it comes to buying ham gear (radio is a hobby, after all). After you buy the HF rig, the 2m handheld, the various antennas, batteries, meters, and power supplies, there might not be much left for computer equipment. But all is not lost. In some ways, those of you forced to buy used, low-power machines may be lucky.

Buying a Cheap Machine

Before you rush out and buy a computer, it is important to step back and decide what it is that you plan to do with the machine. If you must buy cheap, you'll have to think cheap. That is, a cheap used machine is just *not* going to run the latest and greatest software. Windows is out, ditto OS/2, NT, and UNIX. On the other hand, DOS will run just fine, and the overwhelming majority of ham software is currently DOS-based. While this is (very) likely to change (very) quickly in the (very) near future, the older software will still be (very) useful for a (very) long time.

You'll be able to run logging programs, packet radio terminal programs, some TCP/IP programs, and assorted calculators for everything from beam design to grayline plotting. You won't feel left out with a low end machine if you are interested in *using* it (rather then collecting the latest and greatest software, which seems to be a hobby in itself.)

So maybe it's time for a definition of a low power system. Just in case it isn't clear, we are discussing IBM-PC compatible systems. No slight is intended to Macintosh, Commodore, Silicon Graphics, Altair, or any other machine. It is simply the case that the PC is the overwhelming favorite among hams. If you are interested in any of the other possibilities (for example, if you already own a Mac), don't be discouraged, you'll find software and hardware for your machine if you look around. The low power/low end machine I have in mind is an 8088 to 80386SX machine with a 10 to 100 MB hard drive, 640 kb to 4 MB of RAM (Random Access Memory) and MDA (Monochrome Display Adapter—text only) to VGA (Video Graphics Array—color graphics) adapters. This is a relatively wide range of equipment, but all of it is "obsolete" by current standards.

Wait, you say . . . hold on just a minute! I run Windows on my 386SX machine. Yes, you might just—between lockups, GPFs, and reboots—be able to "run" Windows. Folks, regardless of what you say, the 386SX is a machine dead to the latest and greatest software and the 386DX is running a close second. If your SX has 8+ MB of RAM, you'll have better luck, but you will still find it *terribly* slow.

So within this broad range of equipment, how do I choose my low end machine? Well, the basic low end is beautifully embodied in the IBM Model 30. This was a fairly expensive machine when it first appeared. As a used machine, it has a number of advantages that are good examples. First, it is built very well. One thing that all hams—but especially the HFers—will appreciate is that the 30 is *quiet*. No, I am not talking about the fan, though it is quiet that way. I mean RFI. The nicely built box that holds the 30's guts is well sealed against RF leaks, and it just doesn't make radio noise. This is a very important point, because a cheap case can mean that you just can't get on the low bands while the computer is turned on—some machines are incredible RF generators.

The Model 30 also has VGA built-in. It's right on the motherboard. This means that you can view color graphics as decent resolutions. Unfortunately, the monitors that came with the Model 30, made for IBM by Tatung, are notorious for going terribly out of focus—then dying. This means you might have to replace the monitor. If you can find a VGA monitor cheap, great. If not, you can put a monochrome display adapter in the box and use a mono monitor (which you can certainly get cheap) or use a mono VGA monitor, a bit more expensive.

The 30 includes a serial port—a ham radio necessity—and a printer (parallel) port. If you do find a 30 for a good price (less than $500 with monitor) at a hamfest or flea market, *be sure to get the keys and configuration diskettes*. Unlike most clone machines, the key to the Model 30 is a must. It is a real key, which fits a real lock, which really locks the case. The configuration diskette is required to do things like set the system time and configuration. You *need it*.

So, what have we learned from this example? First, since we are buying low end, we can pick up a good name-brand machine. Look for older IBM, Dell, Compaq, AST, Samsung, Hyundai, etc. machines. These are all built very well and won't cost much, since the low end machines are "obsolete." Avoid no-name clones unless you can be sure they come in very good cases; RFI is bound to be a problem in cheap machines.

Color is nice, but mono will work. Don't spend a lot of extra money on color unless you have specific plans for it. You'll find that most ham software for DOS works just fine in monochrome modes. Be suspicious of used monitors; test them or get some sort of guarantee that they will work.

Make sure the machine has at least one serial port. This is standard, but you might be very disappointed if you do not check. All is not lost if your machine is short a port—add-in port cards are cheap and available.

Be sure to get any keys and diskettes for whatever machine you buy. Frequently machines contain hardware that is useless, or nearly so, without the right software. Check this carefully.

Buying New Hardware

If you are ready to go out and spend some money, you'll need to think about the future. Operating Systems and applications are growing in sophistication, and are hungrier than ever for system resources. Lots of RAM and disk space are needed to make things work right. The processor is also an issue, modern software wants lots of CPU.

The best-value processor today is the 80486DX/2 66. This is a processor that runs at 33 MHz outside, but 66 MHz inside. Thanks to the 486's internal cache memory, which can store instructions, this higher internal clock rate makes a big difference in performance. Why not just run the whole thing at 66 MHz? Cost. Building a 33 MHz motherboard is much easier (and so cheaper) than a 66 MHz board.

One important point is to get a motherboard that supports a large external processor cache. By large, I mean greater than 128 kb. Many processor caches are upgradable, so you may be able to start smaller. The importance of this external cache will be obvious when running more advanced operating systems like NT. Performance of NT is dependent upon at least 128K of cache.

Video is very important for a new machine. Do not buy a frame buffer video adapter. A frame buffer adapter is a dumb card that simply provides a memory space that corresponds to the display. Values stored in this memory space determine what appears on the screen. Frame buffers are death to Windows performance. They simply can't deal with the video intensive nature of Windows and will bring even the fastest machine to its knees. Instead of the frame buffer, buy an accelerator. An accelerator card uses its own processor to speed up the video, and can make a dramatic difference in the performance of even the slowest of Windows-capable machines.

8 Mb of RAM is the minimum for a new machine; four simply doesn't hack it. 16 Mb is even better, and Windows-NT-OS/2 performance will certainly show it. A large disk drive is also a necessity. Look at 300+ Mb drives Applications are getting outrageously large, as are operating systems. NT wants 80 Mb! Applications run about 16 Mb each today. AN IDE (Integrated Drive Electronics) drive is fine; SCSI is better (though more expensive). SCSI can take advantage of advanced OS (Operating System) features, and offers a way to attach peripherals (CD-ROM, tape drives, scanners, etc.).

The case of your new machine is very important. It should be worthy of your shack. If you are building a machine yourself, look into a premium case. If you are buying a brand name, you're probably OK. IF you are buying a local clone—look out! Bring a portable HF receiver with you and check for RFI. If the standard case from the vendor is leaky, see if they can supply a premium-quality box. It will cost more, but it's worth the money.

See you next month. Until then, 73 de N1EWO.

ATV

Number 21 on your Feedback card

Ham Television

Bill Brown WB8ELK
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The Ultimate DX

This past July 11th, record-breaking contacts exceeding 2,500 miles on fast-scan ATV (434 MHz) were made by California ATVers watching transmissions from Paul Lieb KH6HME from his vantage point on the side of Mauna Loa volcano on the big island of Hawaii.

The California-Hawaii Duct

This amazing distance was possible due to a tropospheric duct that develops several times each year between California and Hawaii. Usually the duct supports weak signal contacts on 2m SSB and occasionally as high as the 23cm band (and sometimes beyond). The strongest conditions seem to occur each summer (typically June or August) whenever a strong Pacific high pressure system builds up along the path. During a few particularly good openings, 2m FM QSOs have been made with signal levels exceeding S9. The path is usually strongest along the California coast near sea level, while at the Hawaii end it tends to be best at higher elevations. To take full advantage of this unique phenomenon, Paul KH6HME obtained permission from Hawaii television Channel 9 to locate a series of beacon transmitters (6m—23cm) at their transmitter shack high on the side of the Mauna Loa volcano at around the 8,200 foot level (see the article by Gordon West WB6NOA in the July 1991 issue of *73*, p. 14, for a complete description of the KH6HME beacon system). These beacons are usually the first tip-off of the duct opening for many weak-signal DXers all along the West Coast of the U.S. mainland.

The ATV Tropo Experiment

Back in 1991, Gordon West WB6NOA and Tom O'Hara W6ORG brought an ATV experiment over to Hawaii so that Paul could attempt a record ATV contact between Hawaii and California. The ATV experiment consists of a P.C. Electronics' transmitter with an Elktronics VDG-1 video ID and a 100-watt Mirage amplifier fed into a pair of K1FO yagis.

Although there have been many openings since then, none of the ATV attempts prior to this July have been able to produce much more than sync buzz over the path.

Photo A. The KH6HME (Mauna Loa volcano, Hawaii) ATV signal booms into Southern California (reception by Gordon West WB6NOA—2,500 miles).

The BIG One

That all changed this summer when the KH6HME CW beacons were observed pounding into the Californian and Mexican coast on July 10th. Many 2m SSB QSOs were then made by Russ KH6FOO (near sea level at Hilo, Hawaii) and Al WH6VY with the mainland. Early in the afternoon (PDT) on Monday, July 11th, Paul KH6HME arrived at the Mauna Loa beacon site and hooked up the ATV experiment. Signal levels on 2m were now peaking well over S9. As soon as Paul turned on the ATV transmitter, Gordon West WB6NOA received a P4 color picture over an incredible 2,500 mile path (see Photo A). Gordon contacted Tom W6ORG, who spread the word to the Southern Californian ATV community.

New World Record—2,514 Miles

Mike Henkoski KC6CCC of San Clemente heard the news and jumped up to his rooftop to flip his KLM 440-10X over horizontal and point it towards Hawaii. Around 2:30 p.m. PDT Mike received a snowy picture that peaked up to P3+ about five minutes later (see Photo B). Mike sent me a videotape of the contact. It's fascinating to watch as the picture builds in strength to the point where you can actually read the fine print on the ID screens. As a result of this contact, the new world ATV DX reception record is now 2,514 miles! Mike observed the ATV signal for over four hours that afternoon.

The ATV signal was also received briefly (around P1) by Don WA6BHF in Westchester (2,480 miles) and Al KF6YM reported seeing possible sync bars from Running Springs (2,555 miles).

Photo B. The Hawaii ATV signal as received by Mike Henkoski KC6CCC in San Clemente (2,514 miles).

More New Records

This opening also resulted in a record two-way contact between KH6HME and Chip Angle N6CA, with both CW and SSB on 2304 MHz. An attempt to make contact on the 10 GHz band was unsuccessful, however. This opening may well be one of the best yet observed, and resulted in hundreds of new stations working the duct on VHF.

Gordon WB6NOA traveled to Hawaii shortly after the big opening to help Paul KH6HME get set up for the next big ATV challenge: the first-ever two-way ATV QSO between California and Hawaii!

Number 22 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

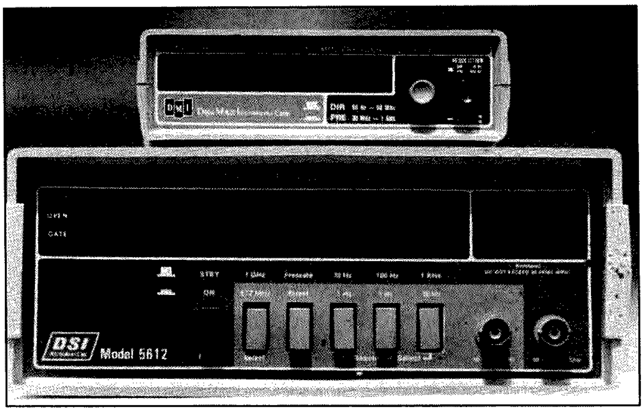

Photo A. Digimax 500 MHz and 1.2 GHz frequency counters, about eight years old and still working well.

VHF/UHF Microwave Frequency Counters

Last month I covered Loran and some of its attributes, namely the calibration of frequency standards, or the internal calibration oscillator of your frequency counter. This month I will cover the various surplus counters that are available. Both inexpensive new counters and surplus units can be a problem from a calibration standpoint. It can be an uphill battle to maintain a frequency reference that is dependable and accurate enough to properly maintain calibration.

This facet of frequency counters, their accuracy and how good their internal references are, is often misunderstood. These internal oscillators require periodic calibration to ensure that your capability to measure accurately is OK. If the calibration standard in your frequency counter is off, your measurements will be as well. The Loran calibration process described in my August and September 1994 columns is but one method of verifying your system's accuracy.

As the frequency of interest becomes higher and higher in the microwave region, the small error that is not important at high frequency becomes larger and larger. If you calibrate your counter with WWV, is it good enough for use? Why use Loran or WWVB at 60 kHz for verifying your standard's frequency? I hope to answer these and other questions this month, and to show the basics in frequency counter acquisition from the eye of a surplus junkie. Well, not only surplus counters—I would like to review some of the very new mini pocket frequency counters as well. In short, I will present what I have learned from all the frequency counters that I have used.

Choosing a Frequency Counter

One type of question that comes up is: If two frequency counters are capable of measuring a specified frequency, say 1296 MHz, which one would you choose? How would you rate the performance and accuracy of each? Is price the only criteria for selection? Whew, what choices!

First, let's start out by stating that almost any counter will do a great job displaying the frequency that you want if it is within the counter's frequency range. There are many other attributes that need to be considered: sensitivity to input signals, digits resolved, agility or ease of use, and accuracy. A counter's ability to display the frequency accurately depends on how well its internal time base (reference oscillator) stays on frequency.

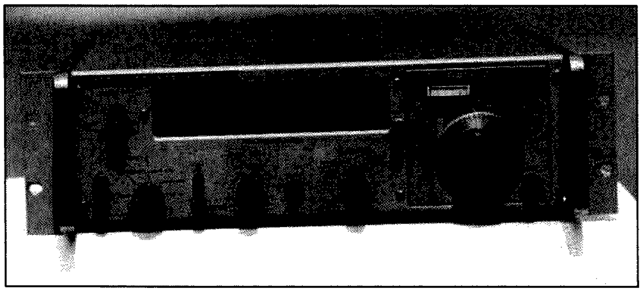
Photo B. My old trusty HP-5245 counter with a 500 MHz plug-in displays 10 MHz frequency to eight digits.

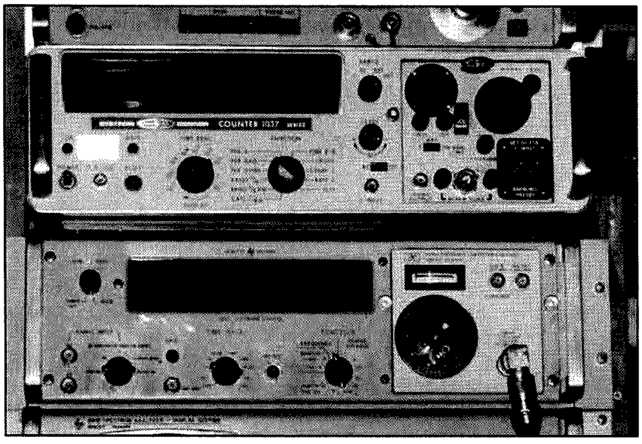

Photo C. Comparison between an HP-5245 with a 3-to-12.4-GHz plug-in (bottom) and a Systron Downer 1037 frequency counter with a transfer oscillator plug-in good to 18 GHz (top).

Let's cover accuracy. Each system has a little different approach on the calibration process that you should be familiar with in order to get good results from your unit. It is not realistic to state that your frequency is OK just because the frequency counter is reading the proper frequency. The frequency might look just fine, but if you don't know what your counter's time-base error is you don't know for sure that your frequency measurement is OK.

Many years ago, in the early 1960s, one of my first calibration attempts was to bring a crystal-controlled HT (transfer oscillator) in to work and set the frequency with the counter there. When I returned home I could calibrate my equipment by a comparison method by retesting the HT's frequency. This process calibrated my first counter, an HP-523, good to 1 MHz. It was used with 74H90, dividing by 10 from VHF. My only other calibration process at this time was WWV at 10 MHz.

How accurate was this system in the mid-'60s? Well, WWV was good to 1 hertz per MHz, and checking the HT at work and then at home proved my test to be within 300 hertz at 2 meters. What a cumbersome calibration method I went through in those early days. In actuality, it wasn't too bad if you could set your 2 meter crystal frequency to something less than 300 hertz. Remember—this was the early 1960s, and while this was not the best, it was doing just fine for amateur standards at 2 meters. At much higher frequencies this was another matter.

The next major quantum leap in counter technology available to amateurs during the latter 1970s was the HP-5245 frequency counter. This counter would count to 50 MHz and had plug-ins that could increase its range to 18 GHz. At the time we were very lucky to acquire an HP-5245 with a 500 MHz plug-in. The other plug-ins were "Unobtainium" because they were too pricey, even in surplus. I remember the HP-5245s still being sold for something near $1,000 in 1985. By the way, I still have my original HP-5245 and it still works well nearly 20 years later; it's a real workhorse. The cost today for an HP-5245 in working condition with a 500 MHz plug-in should be less than $200.

This technology was quite a jump in

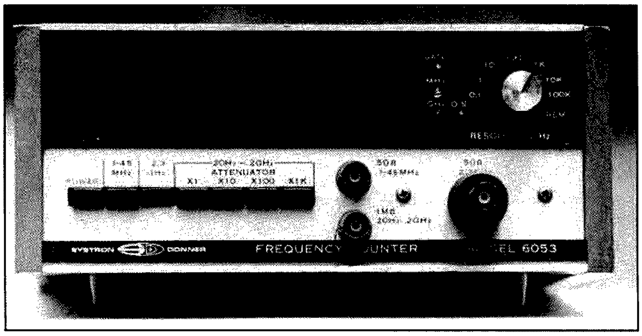

Photo D. Systron Downer Model 6053, direct-reading to 3 GHz.

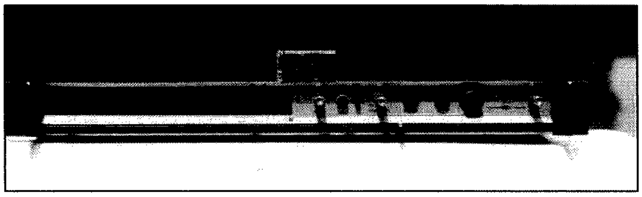
Photo E. The Systron Downer Model 6016, direct-reading to 12.4 GHz. Note the 9-volt battery on top for size comparison.

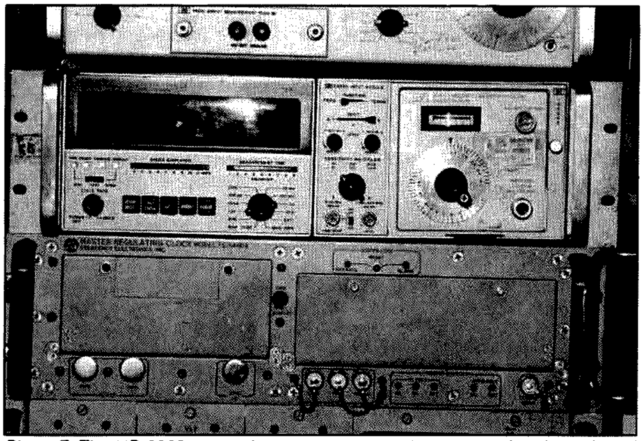

Photo F. The HP-6360 computing counter extremely-accurate time base (0.001 Hz). This counter can do Boolean Algebra calculations with its three frequency inputs. It displays 10 MHz frequency to 11 digits.

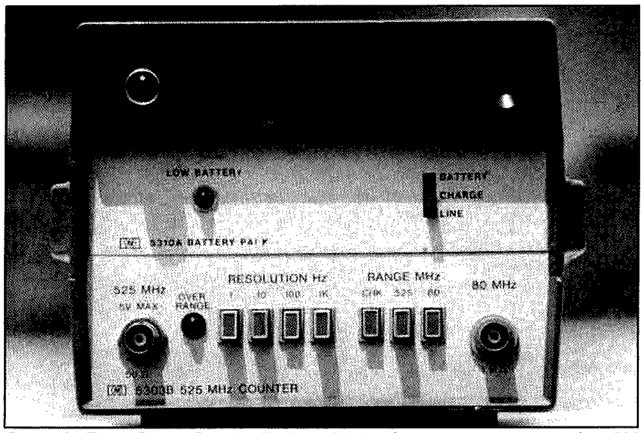

Photo G. The HP-5303B multi-display, with the frequency counter good to 525 MHz. The bottom unit is interchangeable.

performance from my original HP-523. The HP-523 couldn't compare with the HP-5245, which ran circles around it (I then scrapped the HP-523). The accuracy of the HP-5245 was good to 0.1 hertz at 10 MHz. Its calibration could be compared to WWV at 10 MHz and reset to this accuracy with care. However, the internal oscillator could be set more accurately, requiring something other than WWV at 10 MHz. *[Note: To obtain accurate calibration results you must have a standard or reference that has a greater accuracy than the unit you wish to calibrate.]*

Evaluating a Frequency Counter's Accuracy

Let's take a little counter accuracy quiz. I hate quizzes, but let's see what happens in accuracy terms, just for the sake of conversation. Question: What counter would you buy for the best accuracy?

Counter A. 1 part per million (1 PPM)
Counter B. 0.001 %
Counter C. 0.1 hertz per MHz
Counter D. 5 millihertz @ 5 MHz
Counter E. +/- 0.05 hertz per MHz

Sounds like apples, oranges, pears and grapes? It's not all that difficult. What happens is that the accuracy is stated in different terms, just like comparing labels at the supermarket. Let's break the terms down one by one. In all cases, a 10 MHz frequency is measured. With counter "A" (1 part per million—1 PPM), there would be a maximum error of 10 hertz at 10 MHz. With counter "B," 0.001%, the same 10 MHz error would be 100 hertz. With counters "C" or "E," the statements are the same and the error would be 1 hertz. With counter "D," 5 millihertz at 5 MHz, the error would be 0.01 hertz (or 1/100 of a hertz or cycle, if you prefer), making counter "D" the most accurate.

Commercial counters on the amateur market (new) range in accuracies from 1 PPM for units with an internal time base oscillator that is not temperature-controlled, to ones that have higher-accuracy time bases, good to 0.1 PPM or 0.2 PPM. This is usually an option that can cost up to $100 extra. This extra cost is added to the base price, making the total cost between $300 and $400 dollars. The limiting factor here is not the counter itself, but rather the cost of the internal time base crystal oscillator. Here we have the paradox: The cost of a really good time base can exceed the cost of

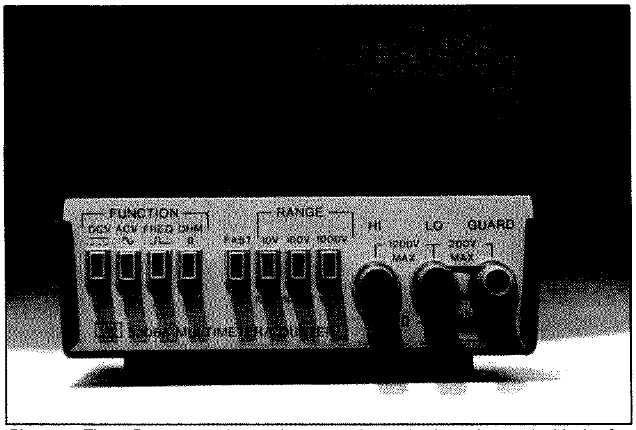

Photo H. The HP-5306 multimeter bottom unit can be interchanged with the frequency display unit to form a multimeter.

a modest frequency counter by a 2:1 ratio. For instance, a very good TCXO from EG&G or a similar manufacturer can cost nearly $300 new for 0.1 PPM accuracy. Costs for accuracies in the 0.001 PPM range are out of sight for amateur pocketbooks.

Frequency counters that use these optional higher-accuracy type TCXOs (temperature-compensated crystal oscillator) or ovenized standards in the new amateur market are typical of products from the following manufacturers (the 800 numbers following these companies are reserved for orders only): Digimax, 800-854-1566, San Diego, CA; Startek, 800-638-8050; or Optoelectronics, 800-327-5912 (the last two are located in Ft. Lauderdale, Florida). Their available products include units that are capable of frequency measurements to almost 3 GHz (their top-line models). In the base- or beginning-line models, frequency measurements are good to 1500 MHz (1.5 GHz). All this in a hand-held portable frequency counter!

What an improvement from my original counter, and even from the first type of units that I purchased! I currently have two of these counters on my workbench, both from Digimax. When I need a measurement in the field, certainly these miniature portable battery-operated counters give great results and as such are part of my tool kit for Field Day operations. Good input sensitivity and ease of use are universal in most basic models. Some improved top-end units have options that can dazzle you with S-meter bar-graph-type indicators, and special features such as triggering and AC/DC coupling in the more expensive models. There are many different types out there and you will have to check the advertisements for the specific model that will serve your needs in a new miniature frequency counter.

Now, don't let me get into trouble here, but I need to insert a disclaimer as I switch from new products to surplus frequency counters: I use both. However, surplus (commercial or military) counters are regarded not as portable units but rather as bench-type units married to the 110 AC mains for operation.

Surplus varieties are usually based on military specifications and as such usually have very high-accuracy oven-controlled crystal time base oscillators within them. This type of oscillator is not inexpensive—costs now run several hundred dollars and up for them. I have purchased junk counters in the $50 dollar range just for the high accuracy time base oscillator, scrapping out the remainder of the chassis for parts. This is sort of a "Hangar Queen" type of operation, using a sacrificial unit to keep others in operating condition. This is a typical method of many instrument suppliers and savvy amateurs, helping to hold down repair costs for parts.

Calibrating these oscillators can be a task. The accuracy of even 0.01 hertz per MHz is better than can be verified using WWV at its best. This is due to the Doppler effect that occurs between the WWV transmitter and the receiver making the comparison. Frequencies good to 0.1 hertz are certainly realizable, but it would be a tough statement to say you can calibrate well to 0.01 hertz using WWV. The accuracy at WWV is good at the transmitter to about 0.000001 hertz, but the path/transmission medium (HF) changes its precision, due to the Doppler effect. It's somewhat like a train whistle whose note is always the same to anyone on the train, but when the train is speeding toward or away from you and the whistle blows, the note changes pitch as the train moves. This is just the same type of thing that the ionosphere does to the radio signal at HF—it changes the frequency slightly, reducing its accuracy at the receiver.

So how do you get out of this predicament? Well, WWV also operates a Very Low Frequency (VLF) transmitter at 60 kHz, doing the same work as WWV at 5, 10, 15 MHz. The 60 kHz transmissions can be used for extremely accurate frequency calibrations. The difference is that at 60 kHz there are no voice announcements. The format is different and so is the

ionospheric performance in that there is minimum Doppler effect in a radio path using ground waves or skywaves. As we covered last month in LORAN operation at 100 kHz, the ground wave is dominant.

Signals are reasonably strong and the calibration is about as good as it gets. Accuracies to 0.001 hertz are commonplace and, with longer time sampling, 0.0001 hertz is possible using older surplus equipment. Now, this kind of accuracy puts to shame the HP-5245 only because it can't resolve enough digits in its display, which is limited to cycles or parts of a cycle when reading these frequencies.

As I said, I still have my old HP-5245 and it still works just fine. In the surplus market I have seen them go for peanuts for they are relay-rack wide and five inches tall—too big for some folks. With the proper plug-in they will work to 18 GHz with very good results. Plug-in ranges are 50 to 500 MHz, 300 MHz to 3 GHz, 2.4 GHz to 12.4 GHz, and 8 to 18 GHz. There is a rather sought-after plug-in called a transfer oscillator; its capability is good from 50 MHz to 18 GHz. The cost of microwave plug-ins varies from $200 to $400.

Don't get rid of these counters because of their age; they are quite acceptable and are capable of giving many years of good service. The HP-5245 type has a cousin in the Systron Downer type counters of the same period, type 1037. Basically, it's the same counter as the Hewlett Packard HP-5245. They look somewhat alike, but there are major electrical differences. The plug-ins are not interchangeable between HP and Systron Downer. Some of the early Systron Donner plug-in units have an "ACTO" unit. It was one of the first to use the automatic tuning of frequency measurement to microwave frequencies that I was able to obtain in surplus. Most of the Hewlett Packard type plug-in units from this period (1970 to the early '80s) used the harmonic mixing technique, together with a high "Q" cavity to resolve microwave frequencies to be displayed on the counter mainframe. These were the early counters that used plug-ins to extend measurement into the high microwave frequency ranges.

As newer types of frequency counters came into existence, several of the Systron Downer types became available in the surplus market. These units did not require plug-ins, and were direct-readable into the microwave region. The first one I acquired in surplus was a Systron Donner 6053 good to 3 GHz. the unit was small, about half the size of an HP-5245. I picked this unit up for $50 because it had a defective time base oscillator. As I maintain a home master oscillator, it was no problem; I set the time base oscillator switch to external reference and I have been using the counter since 1987. Of course, it's tied to the master time base and AC mains, but on the workbench, who cares?

A similar counter that is starting to show up in surplus in quantity is the Systron Donner 6016. This counter is very low-profile: 1-1/4" high and relay-rack wide. Its claim to fame is that it will read frequency to 12.5 GHz directly. The cost on the surplus market for one of these counters in working condition is about $350, and about $200 for one that shows signs of life but needs some attention. By that I mean it works on some ranges but not on all. It's not a junk counter but is partially functional. A lot of money can be saved by doing your own repair if you have some basic test equipment to support the repair function.

Concerning accuracy: If you want the ultimate your frequency counter can deliver, you can shift to an external oscillator for the best accuracy. Most large repair shops or manufacturers refer to this as a house standard, a master frequency oscillator of exceptional stability, good to 0.0001 hertz or better, and distribute it about the facility to reference all other instruments to this same standard. Now when you read frequency at one of several counters they will all be the same. In amateur applications, a master frequency standard would connect to all instruments that need a calibration oscillator (time base). By connecting all counters to this external reference, measurements on all counters should be the same as they share the same time base.

The next generation of frequency counters in surplus is the HP-5360 and the HP-5345 counter mainframes—still a VHF mainframe using plug-ins to reach up into the microwave region. The HP-5360, which I have, uses an adapter, allowing the same plug-in units for the HP-5245 to be used. Improvements on the HP-5360 counter include a very accurate time base oscillator (internal). It's quite comparable in accuracy to my master house standard, a Frequency Electronics FE-10A. Both are good to 0.001 hertz anytime. With a program of calibration, either device is capable of much better accuracies. HP-5360s can be purchased for $100 to $200.

We have high hopes for the Loran project to solve the calibration problems. I'm still having trouble with interference on home Loran applications but I'm still working on the antenna and filters to determine what is going on. I have been told by many people that Loran works best out on the road away from low frequency sources of man-made noise products.

Taking a look with a fast o-scope shows noise spikes disturbing the Loran operation as its pulse information. WWVB is a constant carrier and does not show that much interference affecting its operation. Well, time will tell the tale on this one. I'm still using VLF at 60 kHz to copy WWVB with my Tracor 599J VLF receiver. It's tunable from 1 kHz to 99.9 kHz in 50 hertz frequency steps. A similar type (much newer) can be found in most instrument calibration labs, used to calibrate their master oscillators.

Well, so much for frequency counters and surplus availability, at least what I have observed on the surplus market. As to pricing: These are the prices that I have observed in surplus, with little for guarantees. I hope it gives you some idea of what to expect on the surplus and new market.

A note on the Loran PCBs we spoke about last month: sorry we are sold out. We are always on the lookout for more surplus bargains though, so stay tuned.

Next month I plan to get into frequency references and standards, showing some of the different types of crystal oscillators that exhibit high accuracy. As always, I will be glad to answer questions concerning this and other related subjects. Please send an SASE for a prompt response. 73 Chuck WB6IGP.

ASK KABOOM

Number 23 on your Feedback card

Your Tech Answer Man

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More Electrono-Art

Last time, we were exploring the rash, fun concept of developing a circuit from scratch, without any plans. Let's get back at it:

HELP!!

Even experienced designer-artists sometimes want to make things that don't seem too hard but are out of their realm of experience. Let's say you are trying to design a circuit stage. You know what you want it to do to the signal, but you don't know how to make it work. Sure, you can puzzle it out for hours, but a much easier way to get where you're going is to look through books and magazines for a project which has a similar circuit stage. Don't kid yourself—there ain't much that hasn't been done before. And, even if your idea is very novel, you may find some circuit meant for an entirely different purpose which has a stage like the one you need. You'd be surprised at how much seemingly unrelated circuits can overlap in function. Heck, I've designed things as disparate as a pressure switch and an ultra-sensitive capacitance detector, both using the same pulse processing technique. And, I've found answers to design problems in very odd places, including schematics for old radios and TVs, as well as 20-year-old project magazines. You just never know.

When you do find a clue in another circuit, don't feel as if you need to use it verbatim. Often, you can learn enough from studying the pre-existing circuit to sit down and design your own solution. In fact, I used to have a huge book of circuits, with hundreds of topics and thousands of schematics. I referred to it many times, and it helped me out of lots of jams. Strangely, though, I never actually built anything directly from that book in all the years I had it! It just helped me see solutions which I then applied in my own way.

Make Something

Now that you know the basics of how to get set up to do this kind of "blind" playing, let's walk through the steps and actually design some small gadget. Well, perhaps I should say we'll simulate designing it; it wouldn't be fun if I did all the work, would it?

So, what to make? Hmmm, how about a delayed trigger for your scope? If you've ever worked with a signal which had lots of features between its periodic points, such as a TV signal or digital pulse train, you know how frustrating it can be to see the feature you want when it's somewhere down in the middle of the signal. If you run your timebase slowly enough to see the desired spot, everything will be too scrunched together to let you observe any detail; all you'll see is a blurry dot. But, if you speed the timebase up, the spot you want to see will go off the screen! The proper way out of this dilemma is to use a delayed-sweep scope. All that means is that it has a control which lets you set a time delay between the point at which the scope triggers and when the sweep starts; you simply turn the knob until the portion of the signal you want to see is on the screen.

Unfortunately, many low-cost scopes don't have delayed sweep. If you mostly make oscillators and such, you've probably never missed having it. But, I promise you will run into something one of these days which will require it, and you'll wish you had that delay knob. Even if you never mess with video, you're bound to try and make a CW keyer, identifier, or something like that, and you'll be stuck.

How to Start?

So, how do you get started? Well, give some thought as to what kinds of signals you want to delay. If you're mostly interested in video, you have some special requirements: You need a clamp (to keep the sync tips from wandering around in DC level) and a sync separator. There are specialized chips which will do those things for you, but why bother to order them and wait (not to mention pay), when you can make those fairly simple circuits from stuff you already have? A video clamp is nothing more than a diode, a capacitor and a couple of resistors, and sync separation can be accomplished with one transistor. But how?

If you need to study a video clamp, look at a TV schematic; there should be one just before the sync separator. Or, check out the "Micro ATV Transmitter" article from the July 1991 issue of *73*, and its update in the August issue. (Surely you didn't throw them out, did you??) You can make a clamp just like that one, or you can design your own, now that you see the basic configuration.

Other Signals

If you're not interested in video, your job is easier. Really, all you need to do is to be sure your input signal is big enough to drive the next stage. Often, one transistor inverter stage is all that's required. But what if you anticipate the input signal's being *too* big? Well, an

RC-coupled input with a couple of clipping diodes isn't a bad idea. Once you've designed one, you'll never forget how again.

Next, Please

OK, we've gotten an input signal conditioned to the point where we can use it to drive the next stage. Our signal is now of the proper level (usually something close to the full zero-to-supply voltage swing), and it's nice and clean, with no spikes or noise to trip us up. What, it isn't that clean? Actually, that's a common problem. If you're going to be driving logic chips, as we are in this gadget, it would be a good idea to get rid of as much noise as possible. How? Well, if you're just dealing with pulses, you can run them through a Schmitt trigger stage before you send them on their way. A Schmitt stage is nothing more than a gale which has hysteresis. That is, its turn-on and turn-off points are not the same. So, once a signal turns the gate on, little noise pulses won't turn it off; the signal will have to change quite a bit to make the stage switch. The same happens in the reverse direction. The hysteresis effect can really go a long way toward removing noise. But where do you find one? Well, if you're going the CMOS route, with fairly low-speed signals (under a few MHz), a 4093 gives you four Schmitt NAND gates for under a buck. And, if you only need one, you can still use the other three as regular NAND gates. Which brings up a subject onto which I must digress for a few moments.

Be Subversive

A NAND gate is a NAND gate, right? Maybe, maybe not. A NAND gate can be subverted into being an inverter, and a couple of NANDs can be made to be an OR, a one-shot, or several other kinds of things. All it takes is an understanding of how you hook them together to get your desired function. Theoretically, you could build an entire computer from NAND gates, but you'd have to be crazy, and have a nearly unlimited supply of chips, to try it. For a more practical example, though, I recently had an urgent need for a manually resettable latch circuit. All it had to do was switch once, on the very first pulse it received, and then stay in the same state from then on, until I manually reset it with a push-button. There are plenty of set-reset (SR) flip-flops which do that, but I couldn't find any at 4 a.m., although I'm sure they're here somewhere. So, I used a 25-cent 4011 NAND chip and one resistor to do it, and it worked great. As an exercise in this kind of subversive thinking, see it you can figure out your own latch, using just NAND gates and a resistor. A hint: It only takes two gates.

Back to Our Show

OK, we're ready for the next stage. How do you delay a pulse? The easiest way is with two one-shots, also known as monostable multivibrators. All these things do is produce one pulse for each input pulse. The trick is that the output pulse's width is not determined by that of the input. Rather, it depends on an RC time constant, which means you can control it. Some good 4000-series monos are the 4098, 4528 and 4538. These are all variations on the same theme; the higher numbers are just higher-precision chips with stabler output widths, and all the parts have the same pinout. For our purposes, it doesn't matter which one you use. The first mono is set up to trigger on the rising edge of the input signal; that's called a "positive-edge" trigger. (The pinout diagram shows which trigger is which.) It produces an output pulse almost immediately, and the output's duration depends on the RC values you've chosen. We're going to use that duration to determine the delay, so it's helpful to use a trimpot for the R value, so that we can make the delay variable.

Ta-Da!

OK, so now we have a variable output pulse which occurs on each pulse of the input. So what? Now, let's connect the output of the first mono to the input of the second. Only this time, let's use the negative-edge trigger. So, this mono will fire at the *end* of the first one's duration. And, we don't need a variable duration for this one. As long as the pulse lasts long enough to trigger the scope, we're in business.

A last emitter-follower transistor to buffer the chip's output from the scope's load, and we're done. Let's examine how it works: The incoming signal gets cleaned up and triggers a mono which produces a variable output width. The end of that pulse triggers another mono which puts out a nice, short pulse to trigger the scope. As we vary the length of the first mono, we vary the time before its output falls and triggers the second one. Voilà, variable delayed triggering!

Of course, we haven't actually designed this thing to the point of wiring it all up. If you try it, you may find that, for instance, the output of your clean-up amp is upside down, requiring you to use an extra NAND gate or inverter to get it the right way. Those are the pitfalls of this kind of work, but they're easy to overcome once you get the hang of it.

I hope you've enjoyed this sojourn through the unstructured, arty side of home-brewing. You can use the same approach to develop all kinds of little things, right on up to simple receivers and transmitters. For really big, complex projects, this kind of thinking can get you into trouble. But, for smaller circuits, it often is the easiest, fastest way to turn an idea into silicon reality. And it's fun. 'Til next time, 73 from KB1UM.

73 INTERNATIONAL

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Notes from FN42

This is a busy month! There's lots of information and not enough room for all of it, so I'll make my remarks very brief. Already on tap for next month is more news from China, Hong Kong, Israel, and the Philippines, and who knows what else will show up in the mail.

This month marks David Cowhig's final good-bye to Okinawa. As mentioned last month, he will reside in Taiwan after a deserved break in the U.S. Note his new address, which will also be good after his move to Taiwan.

On to the latest from your world. 73, Arnie N1BAC.

Roundup

Baku Azerbijan *FAX from Howard Barbrey KB9XN:* **4KØIM NOW ACTIVE** Dave Bendt KC9IM has been licensed in Baku, Azerbijan, to operate on all bands and all modes. The license was effective on May 1, 1994. If anyone would like me to forward a Xerox copy of the license, I would be happy to do so. Dave is the first U.S. operator to be licensed and he holds the calls of TL8IM, KH2AD, KC9IM, and YBØAIM. I will be handling QSLs for Dave during his stay in Baku, which will end in approximately 18 months. Look for Dave on 20 meter phone, and hopefully on the WARC bands also.

Thanks and 73, Howard Barbrey.

Brazil *QSL Manager List from Ronaldo Bastos Reis PS7AB:* For those of you who need an extensive QSL Manager List of Brazilian hams *[5 pages]*, please send US$1 or 1 IRC to: Ronaldo Bastos Reis PS7AB, PO Box 2021, Natal, RN, 59094-970, Brazil. It is published in July and December.

Mount Athos *Letter from Walery Sawka KB2FIV: Last week I received a letter from my friend SV2ASP/A, a.k.a. Father Apollo of Mount Athos, Greece. I wish to share it with other readers of your column. He is back on the air after one year of humble silence! Too bad he never resolved his famous grievance with the ARRL in some meaningful and civilized fashion. I might see him in person this coming fall, with more news and pictures. I wish him all the joy in his radio hobby.*

"Dear DX friends: It's been over two years since Mount Athos went off the air as a protest to ARRL, which, despite the evidence we provided and despite our efforts, finally recognized and approved the illegal transmissions of DJ6SI Baldur Drobnica, from Mount Athos.

As an amateur radio operator and as a Mt. Athos monk, I did my duty in trying to prevent lowering the quality of amateur radio to a level of self-interest, as amateur radio admittedly includes in its entirety many worthy individuals.

However, since many individuals and clubs all over the world insist and beg for the amateur radio voice of Mt. Athos to be heard again as a message of hope and peace to our troubled world, I want to make it known that in the coming year I will occasionally use some of my precious time to see to it that the serene and "out-of-this-world" voice of Mt. Athos will once again be spread to the ends of the earth.

And this, despite my justified grievances toward ARRL, which, as if what happened with DJ6SI was not enough, recently tabled a proposal to expel Mt. Athos from the DXCC list.

But ARRL ignores the fact that Mt. Athos is the continuation and survival to this day of the Byzantine Empire. Despite the fact that it is under the jurisdiction of the Greek State, it has its laws as it is a self-ruled part of it. This privileged status of Mt. Athos has been officially adopted by the European Community, while the undisturbed continuity of its unaltered life has exceeded 10 centuries.

Photo A. QSL card of N2CQR/HI8, Bill Meara, Hambassador to the Dominican Republic.

I remain with the conviction that a similar situation will be avoided in the future and send you my best wishes from Mt. Athos.

God Bless You, SV2ASP/A Apollo Monk."

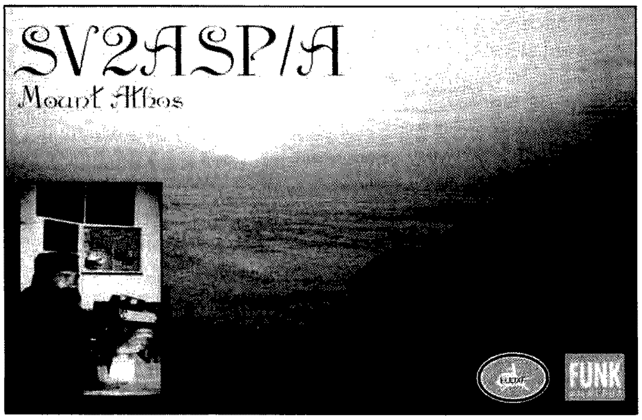

Photo B. Another OSL card of SV2ASP/A, Monk Apollo.

Switzerland *From the International Telecommunication Union (ITU) Newsletter:* The European Radiocommunications Committee (ERC) of the European Conference of Postal and Telecommunications Administrators, the regional telecommunications organization for Europe, has developed regulatory mechanisms to ease the establishment and operation of amateur stations in Europe. CEPT Recommendation T/R 61-01 was recently revised to permit nationals of any country willing to apply the recommendation to operate their amateur stations during short stays in a CEPT country that also applies the recommendation without any further formalities. Three non-CEPT administrations have already joined this process, known as the CEPT radio amateur license.

In a new development, the ERC at its March 1994 meeting in Cyprus revised CEPT Recommendation 61-02 on the Harmonized Amateur Radio Examination Certificate. Again, non-CEPT countries can also participate in this regulatory process. This will permit radio amateurs holding an approved certificate to obtain without further examination an amateur license in any CEPT country in which they are resident and which has implemented Recommendation T/R 61-02.

Any ITU Member administration can, subject to the successful completion of the process, participate in Recommendations T/R 61-01 and T/R 61-02. If further information is required please contact: European Radiocommunications Office, Holsteinsgade 63, DK-2100 Copenhagen (Denmark); Tel: +45 35 43 24 42; Telefax: +45 35 43 35 14.

Ukraine *Letter from Boris Chuistov UU5JK:* I have known your *73* magazine for a very long time since I've been licensed, and I was glad when I found your February 1994 issue here in Ukraine, an old and nice acquaintance of mine! Not expensive, good articles, nice columns "Ham Help" and "Barter 'n' Buy."

Now we have here an independent state of Ukraine, free press, and no Iron Curtain. We can even subscribe to *73 Amateur Radio Today* and send QSL cards directly to your country and the world.

I am a Russian ham of Extra license with home-brew equipment, like all our amateurs have in the former USSR, as there is not the amateur equipment and radio parts on sale in this country.

I live in Yalta, Peninsula Crimea, on the Black Sea. I am married, with one son, and work as an electrical engineer for a local construction firm.

Now we all changed our prefixes of the callsigns for the different independent countries of the ex-USSR, and Ukraine has now US, UR, UT, UU, UX, and UY prefixes, with the numbers 1 - 0. The Crimean region, where I live (Oblast 067 for W-100-0 awards), uses the prefix UU.

I send greetings to all hams and hope to make contact with them in the future. All letters and QSLs will be answered.

Best wishes from Ukraine, Boris Chuistov UU5JK, PO Box 20, Yalta, Crimea, 334200 Ukraine.

DOMINICAN REPUBLIC

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Greetings from Santo Domingo! I have no central theme for this dispatch—just some "odds and ends" from HI8.

When I got back into ham radio last year, I decided to earn my spurs and do some building. I wondered about how I would be able to find parts in Santo Domingo. I soon discovered that finding components here can be challenging and fun. There is only one Radio Shack outlet in Santo Domingo, and it is very lightly stocked, so a ham

engaged in rig building has to learn where the real "electronic parts markets" are. There is one street here with seven or eight electronics shops. Very little is thrown away, so the shops in Santo Domingo's "electronics district" are full of used components salvaged from broken stereos, TVs, etc. When a choke or transformer burns out, there are several small businesses standing by to rewind it.

Of course, the most important source of spare parts here is the collective junk box of our radio club's membership. This source is particularly important for those of us running older gear. Imagine being in a foreign country and trying to come up with switch wafer FS1 for an ailing HT-37 . . . or the IF filter for an HQ-100! With the help of my fellow hams, I was able to find both these parts in short order right here in Santo Domingo!

A U.S. ham operating from HI8 soon finds himself standing astride the gap that divides two different worlds—with one foot in each! You never stop being an "N2," but you learn a bit about how ham radio looks from HI8! Appropriate of my "odds and ends" theme, I thought I'd use this column to offer a few observations on the use of the Spanish language in ham radio.

Non-Spanish-speaking hams probably perceive Spanish language radio transmissions as a lot of indecipherable high-speed chatter. Those of us who do understand the language know that amidst that chatter one can find the full range of radio conversations: the good, the bad, and the ugly! On the bad and ugly side, you'll hear lots of talk that seems to have little to do with our hobby and more to do with efforts to reduce telephone bills. On the good side, you'll hear many, many QSOs in keeping with the highest traditions of ham radio. Spanish is a very graceful, courtly language that allows for elegant expressions of friendship. Non-Spanish-speaking hams would probably be surprised by what they could hear if they could program their computers to translate QSOs from the Hispanic world! Instead of the "Old Man" used by English speaking hams, the Spanish speaking world seems to go with a simple "Amigo," i.e. "Buenos Dias Amigo Bill!" The very warm fraternal "Hermano" (brother) is frequently used in a sincere manner—even during first contacts! I think English-speaking hams would find Spanish language QSOs very florid, filled with lengthy expressions of best wishes and kind remarks about the other ham's country.

I find that hams from Spanish-speaking countries really appreciate it if a U.S. ham makes the effort to use Spanish. Put yourself in the other guy's shoes: Imagine having to do most of your QSOs in a difficult foreign language! You can almost hear the happiness on the other end when you make the switch to Espanol. This works even in CW (where Hermano and Amigo are also used as described above). The Hispanic world is famous for its tolerance of foreigners who butcher the language. By all means, pull out that high school Spanish and incorporate it into your operations. *[Article continued next month.—Arnie]*

OKINAWA

David Cowhig WA1LBP
AIT TAIPEI
Department of State
Washington, D.C.

I do Japanese language packet contacts in my Okinawa home using my aging 386SX PC running PC-DOS 5/J (J for Japanese language) at my 7J6CBQ home station. I use the WTERM freeware program and the AEA PAKRATT 232. In English-language packet, data is exchanged at a one-character-per-byte rate using the 128-character standard ASCII code. In Japanese language packet, two bytes are used to exchange each character since the 5,000-odd characters of the Japan Industrial Standard (JIS) standard character codes I and II cannot be expressed using just the 256 code combinations in one byte. The DX-TERM packet program now available for Japanese DOS automatically displays NAPLPS videotext images if NAPLPS code is encountered amidst packet data!

Okinawans are preparing to commemorate the 50th anniversary of the Battle of Okinawa during 1995. Every June 23 Okinawans commemorate the Battle of Okinawa, one of the most murderous battles in history, which killed over 200,000 people, mostly Okinawan civilians. Some American veterans of the battle will travel to Okinawa next year to participate. Many Okinawans in their sixties and seventies today have memories, like the taxi driver who told me last week "After my father was wounded in the battle, he came home to us and we all fled north. Later, in the summer of 1945 as we starved in the wooded hills of northern Okinawa, we decided to surrender to the American soldiers. Although the Americans shot at people who ran away from them, they took care of people who came to them and surrendered. I had caught malaria during those months in the woods. I am here today only because an American soldier gave me the medicine that made me well. Many of us feel very grateful to the American soldiers."

Another man, a survivor of the Battle of the Kerama Islands, told me in April how his parents tried to kill their entire family because of the fearful stories they had been told about American soldiers. Many people in the Kerama Islands to this day feel grateful to the American medical corpsmen of the U.S. Army's 77th Division. Recently, I heard that some veterans will return to Okinawa in 1995 on a tour being organized by Military History Tours of 1500

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This week I say good-bye to Okinawa, Japan, after partying vigorously with many of my JS6 friends. My two-year stay in this borderland between China and the main islands of Japan has been great fun. The great Japanese writer Oe Kenzaburo, author of *Okinawa Notes*, has said that the warmth and positive outlook on life of the Okinawans he experienced for three years 20 years ago transformed him and made him "Okinawa sick" forever after. The Okinawan traditional sayings "inochi du takara" (life is a treasure) and "ichari ba chode" (to be like brothers and sisters from the first meeting) give an idea of this Okinawan outlook on life. My JS6 ham friends and many other Okinawan friends have helped me understand how Oe Kenzaburo feels about Okinawa and how I too have become "Okinawa sick."

PEOPLE'S REPUBLIC OF CHINA

Rick Nui BZ1QL
Room 316 Building 25
Tsinghua University
Beijing 100084
People's Republic of China

Both my club and I wholeheartedly appreciate the *73* magazine's reprint of our *China Ham News* bulletins. With no 2 meter packet net in the Beijing area, SB this WW is not a breeze. I have been very grateful for the relay help offered by JA5TX, KE7XO, WA8DRZ, VK2AGE and many other BBS gateways. Please go ahead, gentlemen, as the world needs to know about modern China. TU!

National ham exam: The first-ever Individual Amateur Radio Operator's License exams were scheduled to be held July 16 and 17 in up to 26 cities nationwide. Organized and processed by the Chinese Radio Sports Association (CRSA), the tests cover five different categories: 1. V/UHF Class 3 (CW/SSB); 2. V/UHF Class 3 (SSB); 3. HF Class 3 (CW/SSB); 4. HF Class 3 (SSB); 5. Class 4 (SWL). Different requirements exist for different classes. Some of the contents of these exams are radio regulations, communication procedures, radio fundamentals, hamspeak, international phonetics and Morse code TX/RX.

TUARC on CCTV TUARC was again on television May 29 in one of China Central Television's most popular programs, "Studio 12." The show was about 10 recently-elected Student Elites of Tsinghua University where Rick, the TUARC Public Relations Manager, was one of them. Welcomed by an audience of millions, especially young men and women, "Studio 12" broadcast all throughout China every Sunday evening during the golden time slot 2125-2200, focusing on economic reforms, national policies, social phenomena, youth problems and other sorts of current affairs.

"CQ Taiwan" report A TUARC article written in English was translated into Chinese and got published in the February issue of Taiwan's *CQ Amateur Radio* magazine. As many as 13 photographs accompanied the article, showing the BY1QH QSL cards, the Tsinghua University campus, and what the club has been doing during the past one year. Thanks to Bear BV2WC, the *CQ* editor, for all his efforts. We also compliment him on his excellent interpretation.

Yet another quad If everything goes OK, a booming signal on the three WARC bands will have appeared early in June through our newly designed and erected 2-el cubical quad. Dieter prepared all the cables, wire and a lovely switch box with four red/green LCDs on it, while Sean was in charge of the entire project. Mike and Henry cleaned and painted the steel frame, Mark and Gray measured and cut the bamboo, John drilled eight holes on the angel iron, Will bought some other hardware—it is teamwork that counts. Planned date for installation was June 5.

CQ WPX test As a Single Single Low Power contestant, Rick BZ1QL took part in the CQ WPX CW Contest with the club call on May 28 and 29, operating DJ7BU's Kenwood 440S into a 4-el 20 meter monoband yagi fixed north. A lot of fun. Europe has been fairly easy to work with, not to mention Japan, while there's not much propagation from stateside. By this time next year there will have been a good number of BGs and BAs coming out in China so the world is going to enjoy more unique prefixes from BY land.

China on OSCARS Klaus DJ3NY and Sean BZ1LUV set our FT-726R to 145.812 but nothing was heard when AO-13 was overhead. The German OSCAR enthusiast, currently traveling in China, visited TUARC and helped us check the satellite ground station on May 29. A longtime chap of Dieter DJ7BU's, Klaus brought some N-type connectors to the club during this trip.

Rotor report The very last packet message from Presley N5VGC informed us that the needed parts for our broken CDE HAM IV rotor had been on their way to Beijing from Dallas. With fax, packet radio and airmail involved, our cowboy pal did us a great favor one more time. When we get the rotor repaired, hooked up and running fine, we'll turn it directly to Texas.

TUARC can be reached via any of the following paths:

Digital: BY1QH @ JA5TX.JPN.AS

Internet: Contact gateway_request@Arasmith.COM

Airmail: Rick Niu, Public Relations Manager TUARC, Room 316 Building 25, Tsinghua University, Beijing 100084, People's Republic of China.

NEVER SAY DIE

Continued from page 4

lists. And scientists have a giant problem coping with the concept of life. They've been doing a good job of tracking down matter . . . well, they were doing pretty well when they got it down to atoms, but then some wiseacres weren't satisfied. They wanted to know what atoms were made out of. That got them down to protons and electrons, neutrons and positrons. A few more unsatisfied wiseacres wanted to know what those things were made of. I'm not sure quarks have been that helpful, even now that they think they've finally cornered the sixth, and supposedly last, the top quark. So what are quarks made out of? Let's spend a few billion dollars and find out. And let's know more about K, mu, tau, and pi-mesons. And muons.

Medical scientists have been doing about the same thing with the materials of life. They've taken cells apart and found DNA, a complex molecule with the ability to replicate itself. Now they're busy taking our genes apart and cataloging them with the genome project. But the scientists still haven't a clue as to what makes life.

Perhaps the missing element is one they haven't looked for yet . . . awareness. That's the one really basic difference between the animate and inanimate. How does awareness fit into all this? Consciousness? The mind? Sentience? All living things seem to have awareness, even single cells. Plants and trees seem to have some sort of awareness in that they fight back with chemicals when they are attacked. Apparently it doesn't take a brain for something to have awareness. Awareness, whatever it is, seems to be a property of all life, and thus presumably is the most firmly hardwired circuit of our system.

Plants show an awareness of other plants, and of people. People experience telepathy and other such psi phenomena, so there is some sort of an awareness to awareness communications system which is quite different from molecules, DNA and genes.

Scientists will, I believe, achieve a lot more progress with their medical research when they have a better understanding of life and the awareness that goes along with it. This means researching things that scientists really hate . . . like placebos, prayer, psychic healing, mob psychology, and so on. However, as Barrow and Tipler say in their *The Anthropic Cosmological Principle*, "Physicists . . . are loath to admit any consideration of Mind into their theories."

But then scientists have a long way to go in every branch of science. Physicists still don't agree on what gravity is. Or inertia. Or even what electricity really is. They don't know for sure whether there are magnetic or gravity "fields" or not. In biology they don't know yet how cells decide when to duplicate and how they know what part of the body they are making or replacing. How do they know to become part of a toe? The blueprint, they think, is in that big mess of DNA, only about 10% of which seems involved with the blueprints for the current model human being. They also don't have a clue as to how memory works or how we can retain memories for a lifetime when every cell in our body is being replaced every so often. They don't even know if memory is in the brain. If it is, how come plants, which are even more brainless than some people I've met, have memories?

And how come some people who've lost 90% of their brains still have their memories? And other people with a different 90% of their brain missing, also have their memories?

It gets worse. I was just reading that if you take some of your blood out and connect a sensitive galvanometer to it, even though it is miles away from you it will register the same swings the blood in your body is registering at the time. You can watch it respond as you are calm, excited, having sex, and so on. This almost makes me wonder about what conflicts may result from blood transfusions. It also may help explain how identical twins have so many common events in their lives, even when living apart.

There are many theories of how life got started, but none, other than the Hoyle-Wickramasinghe theory of evolution from space, has any explanation for the existence of such universal awareness. And even their theory only moves the creation of life back one level of abstraction (thanks Korzybski!). However, no amount of taking DNA apart has yet given us any inkling as to how awareness developed. Of course it had to, otherwise we wouldn't be able to hold our ground in the eternal light for life.

Every plant and animal has to fight on some level for food and the ability to reproduce. Plants do it slowly and man more quickly, with guns and bombs. Awareness is necessary for life. But how did it develop? And what is it?

It Gets Even Worse

Once we recognize that consciousness is something separate from the physical body, we open a very messy door. Then we can no longer categorically deny the existence of non-physical phenomena. Once we open this can of worms we're dealing with what are often non-repeatable experiments. Worse, since this is a fuzzy area, it's alive with con artists. In the medical field we have quacks, both well-meaning and mercenary.

For instance, take out-of-body experiences. I've read some very convincing reports on them. I even attended a Mensa-sponsored conference where Mensa research teams reported on their amazing success with getting people to see what was in a basket hanging up near the ceiling — when not even the experimenter knew what was in it. The only way to avoid confusion once you get into the non-physical is to just refuse to believe anything, no matter how well researched. Fortunately, many people (including scientists) are able to do this. I consider this pathological skepticism.

Instead of ridiculing experimenters and trying to discourage research, we should admit that there just may be some things we don't know about yet and do what we can to learn more. So let's check out precognition, fortunetelling, psychometry, past lives, reincarnation, telepathy, telekinesis, mind reading, auras, Kirlian photography, ghosts, psychics, near death experiences, poltergeists, UFOs, contactees, prayer, haunted houses, voodoo, Indian fakirs, dowsing, Ouija boards, automatic writing, Tarot cards, astral travel, palmistry, phrenology, astrology, all religions, angels, miracles — stuff like that. Sure, some of it is baloney. But is all of it fantasy?

On the medical side of things, how about homeopathy, acupuncture, herbal medicine, ultraviolet light therapy, hydrogen peroxide, photoluminescence, dental amalgam, and so on?

How come so many of the great composers have said that their music often suddenly came to them in completed form when they were dozing off?

We're pretty good at cramming a million or so transistors on a tiny silicon chip, but we've hardly even peeked into the realm of consciousness. That's been off-limits.

The only way I know to be a skeptic (a disbeliever, as opposed to an agnostic) in many of the paranormal fields I listed is to avoid reading about them. For instance, I've just finished reading *Across Time and Death, A mother's search for her past life children*, by Jenny Cockell, a story by a woman who remembered a previous life in good detail and checked up on it. It's a Fireside Book, $10 in paperback. There are a bunch of good books on reincarnation. Two in pocket books are by Michael Talbot and Edith Fiore.

Psychologists frequently find their patients suddenly recalling a past life when under hypnosis. When I was working as a professional psychologist I often found there were present-life problems that could only be resolved by going to a past life, and they were always right there, easily contacted. I also found that anybody can recall a past life. Everybody has 'em.

Indeed, many children annoy their parents with memories of their most recent past life, but these usually fade away by the time they're three or four. At this age it doesn't take much discouragement by one's parents to shut off these memories.

Now how does reincarnation fit in with the 100,000-plus proteins that make up our bodies? Or genes, DNA, and so on? Maybe you'd better check out *The Secret Science Behind Miracles* by Max Freedom Long from your library and see how that goes down.

Author Barbara Taylor Caldwell has made a career out of writing about her past life experiences. Historians have been amazed at the historical accuracy of her novels. Maybe it's time to take a closer look at the mystery of life, which may have little to do with our physical universe, atoms, the speed of light, and even time, itself.

Number 25 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

*Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check **Special Events File Area #11** on our **BBS (603-924-9343)**. for listings that were too late to get into publication.*

OCT 1-2

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL KY State Conv. will be held at the Common-wealth Conv. Center in downtown Louisville. Mail requests for tickets or info to *The Greater Louisville Hamfest Assn., PO. Box 34444-Q, Louisville KY. 40232-4444.* For commercial spaces, call *(812) 948-0037*; Flea Market spaces, *(812) 282-4898.*

OCT 2

HUNTINGTON, IN The Huntington County ARS will sponsor its 6th annual Hamfest from 8 AM-1 PM at the PAL (Police Athletic League) Club. Set-up at 6 AM. VE Exams. Flea Market. Talk-in on 146.085/.685 and 448.975/443.975. Contact *Chris Richardson N9QVI, PO. Box 284, Huntington IN 46750. Tel. (219) 356-0319.*

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot - Flushing Meadow Park, 47-01 111th St. Set-up at 7:30 AM. Doors open at 9 AM. Talk-in on 444.200 WB2ZZO Rptr.; 146.52 simplex. For reservations, call eves., *Arnie Schiffman WB2YXB, (718) 343-0172; Charles Becker WA2JUJ, (516) 694-3955.*

SAN DIEGO, CA Over a dozen San Diego ARCs, the American Red Cross, and the Salvation Army, will stage the 3rd annual "Ham Radio Roundup." Location: Missile Pk., Missile Rd. & Clairemont Mesa Blvd. Each club or agency (ARRL, MARS, and others) will display the various aspects of amateur radio. Set-up begins at 7 AM; gates open at 10 AM. Contact *Harry A. Hodges WA6YOO, (619) 743-4212.*

OCT 8

GRAND FORKS, ND The Forx ARC will hold their Hamfest/Computer Fair at Grand Forks Civic Auditorium, 615 - 1 Ave. N., starting at 8 AM. Setup at 7 AM. VE Exams at 10 AM, walk-ins welcome. Talk-in on 146.94. Contact *Bob Smith ND1H, 1203 Shakespeare Rd., Grand Forks ND. Tel. (701) 746-9498.*

ST. PETERSBURG, FL The St. Petersburg ARC (SPARC) will sponsor its annual Autumn Hamfest from 8 AM-1 PM at First Unity Church, 469 45th Ave. North. Contact *Caddie Wilmshurst KE4EME, (813) 527-3426.*

TEANECK, NJ The Bergen ARA will hold its annual Fall Hamfest from 8 AM-2 PM at Fairleigh Dickinson Univ. in Teaneck. Please pre-register for spaces with power. VE Exams. Talk-in on 146.790/.190. Contact *Jim Joyce K2ZO, (201) 664-6725.* Please, no calls after 10 PM.

OCT 8-9

MEMPHIS, TN "MemFest '94" Greater Memphis Amateur Radio/Computer Show will be held at Shelby Farms Show Place Arena, 105 Germantown Pkwy., in Germantown TN. The Greater Memphis Amateurs will host this event Sat. 8:30 AM-4 PM; Sun. 8:30 AM-2 PM. VE Exams both days 9 AM-Noon. Talk-in on 144.61/145.21, 447.00/442.00 and 1272.00/1292.00. For Flea Market info, contact *Lee Bowers KA4KVW, (901) 867-3461 after 6 PM.* For general and exhibitor info, call *Steve Fletman KC4ZOV, (901) 363-3159 after 4 PM;* or *Mary Moore AC4GF, (901) 758-0661.*

OCT 9

DURHAM, CT The Meriden ARC, the Middlesex ARS, and the Shoreline ARC will co-sponsor the Nutmeg Hamfest and CT State ARRL Convention at the Fairgrounds on Route 17 in Durham. Time: 9 AM-3 PM. Campsite and vendor setup at 4 PM Sat., Oct. 8th. VE Exams; call *Ted Trudel, (203) 345-4008* to register in advance. Computer Flea Market. Talk-in on 145.29 Rptr. Vendors contact *John Bartscher-er, (203) 238-2453, days.* For general info, call *Jim McCandless, (203) 349-3353 eves. Packet: N1GNV @ W1NRG.CT.USA.NA; Internet: wilsonc@iia.org.*

LIMA, OH The Northwest Ohio ARC will hold a Hamfest at Allen County Fairgrounds. Doors open at 8 AM. Set-up after 4 PM Sat., Oct. 8th. VE Exams, all classes pre-register with completed 610 and check for $5.75 payable to *ARRL/VEC.* Send to *Jon Solomon, 1370 Stevick Rd., Lima OH 45807.*

LINCROFT, NJ The Shore Area Hamfest - '94, sponsored jointly by the Jersey Shore ARA, Neptune ARA, Ocean-Monmouth ARC, Garden State ARA, and the Brookdale ARC, will be held at Brookdale Comm. College in Lincroft. VE Exams at 0900. One CW test session will be held at 0930. Dealer set-up at 0600; doors open to the general public at 0800. For reservations and/or tickets, send an SASE to *Shore Area Ham and Computerfest, PO. Box 635, Eatontown NJ 07724-0635* before Sep. 25th. Talk-in on 145.485(-). For info, contact *Al Allen K2LG, (908) 495-3246.*

SACRAMENTO, CA The Student ARC of California State Univ.-Sacramento

will sponsor a Swap Meet on the campus located at US 50 and Howe Ave. The Swap will be held from 7 AM-Noon. Talk-In on 145.230(-dup PL 162.2). Contact *Gary Webbenhurst KC6URB, (916) 381-6602, eves.*

OCT 15

DEWITT, NY The Radio Amateurs of Greater Syracuse will hold its 39th Hamfest from 8 AM-3 PM at the Academy Green American Legion Hall in Syracuse (between S. Salina St. & Valley Dr.) Set-up at 7 AM. VE Exams. Write to *RAGS, Box 88, Liverpool NY 13088;* or call *WA2PUU, (315) 469-0590* Talk-In on 147.30 MHz.

JOHNSON CITY, TN The 14th annual Tri-Cities Hamfest will be held at the Appalachian Fair Grounds located off I-181 in Grey TN. The Kingsport, Bristol, and Johnson City Radio Clubs will co-sponsor this event. Flea Market. Mail inquiries to *Tri-Cities Hamfest, P.O. Box 3682 CRS, Johnson City TN 37602.*

SANFORD, NC The Lions Club Fairgrounds at 7th & Weatherspoon Sts. has been chosen by the Central Carolina ARS as the location for its Fall Festival. Time: 8 AM-4 PM. Contact *April Maggart KD4QMU, 8512 Deep River Rd., Sanford NC 27330.*

SCOTCH PLAINS, NJ A Hamputer Fest will be held by the Tri-County Radio Assn. from 8 AM-1 PM at Union Catholic Regional H.S. Walk-in VE Exams. Bring check for $5.75 (except Novice exam), made payable to ARRL VEC; bring your original license plus a Xerox copy, 2 forms of ID, pencils and a pen. All who wish to take the exams must be in the exam room by 9:30 AM. Pre-registration is required for tailgating spaces and flea market tables. Contact *Dick Franklin W2EUF, 310 Indian Trail, Mountainside NJ 07092. Tel. (908) 654-4943.* Talk-in on 147.255/.855, 449.975/444.975, and 146.52.

WAYCROSS, GA The Waycross Area Rptr. Assn. 3rd annual Hamfest will be held at Waycross Ware County fairgrounds Exchange Club bldg., Hwy. 82 East. Open 8 AM-4 PM. Talk-in on 146.640 Rptr. License exams, all classes, at 9 AM. Contact *Don Minchew KD4CEX, (912) 283-9553; Woodrow Kirten N4UNC, (912) 449-5357;* or write or call *David Sweat KD4FGC, 3492 Wren Dr., Waycross GA 31501. Tel. (912) 283-4603.*

OCT 16

BENSALEM, PA The Penn Wireless Assn. will hold its annual TRADEFEST from 0800-1400 hours at the Robert Yezzi Fairgrounds on Hulmeville Rd. Auction. Vender setup at 0600. Pre-register by Oct. 1st to *PWA, P.O. Box L-734, Langhorne PA 19047;* or call *John N3NUB, (215) 355-0879.* VE Exams. Exhibits. Talk-in on 145.25/144.65, 146.925/146.325, 448.225/443.225 and 146.52 simplex.

LONG ISLAND, NY The Long Island Mobile ARC will hold a Hamfest outdoors at the New York Institute of Tech., Rte 25A, in Old Westbury NY. Time: 9 AM-4 PM. VHF Tune-up Clinic. Talk-in on 146.25/.85. Contact *Neil Hartman WE2V, (516) 462-5549.*

TUCSON, AZ "Tucson Hamfest '94" will be sponsored by the Old Pueblo Radio Club, ARRI and ARCA. The event will be held from 7 AM-1 PM at De Anza Drive-In, 22nd St. and Alvernon Way. Talk-in on 146.22/.82, 146.28/.88, and 146.52 simplex. Contact *A.J. Pawlowski KB7KZ, 3418 W. Green Trees Dr., Tucson AZ 85741. Tel. (602) 742-2605.*

OCT 22

FRANKLIN, PA The Fort Venango Mike & Key Club will host its Ham Radio Auction & Flea Market starting at 8 AM at Venango County 4-H Fairgrounds, (Route 62 between Polk and Franklin PA). Auction at 10 AM. Talk-in in 147.12(+), 145.23(-), and 145.19(-). Contact *Doug Smith N3BDJ, (814) 677-6523* or *Bruno Wolozyn K3MHB, (814) 677-8694;* or write to *Fort Venango Mike & Key Club, RD #1, P.O. Box 591, Cranberry PA 16319.*

OCT 23

SELLERSVILLE, PA The Sellersville Nat'l Guard Armory will be the location for a Special Event that will be held by the RH Hill ARC. VE Testing starts at 9 AM, all classes. Bring documents. Contact *Linda Erdman, (215) 679-5764;* or *P.O. Box 29, Colmar PA 18915.*

WARREN, MI The "USECA SWAP" will be held at Macomb Comm. College, South Campus Student Comm. Center (K-Bldg.) at 12 Mile Rd. & Hayes. Doors open at 8 AM. VE Exams, pre-registration required; call *Bill N8CVC, (313) 468-8345.* Computer Hardware/Software. Ham Gear. Electronic Parts. Connectors and Cable. To register for tables, call *Virginia N8NLS, (313) 268-0691* or *Kevin N8QVX, (313) 772-8082.* Talk-in on 147.18(+) or 146.42 simplex. Make checks payable to *U.S.E.C.A.* and mail with legal size SASE to *Virginia Przekaza, 34473 Coachwood Dr., Sterling Hts MI 48312.* Sponsor: Utica Shelby Emergency Communications Assn.

WAUKESHA, WI The Kettle Moraine RAC Inc., will hold its 16th annual Ham Radio/Computer Swapfest at the Waukesha County Exposition Center, Hwys J & FT. Reservations accepted until Oct. 14th. Doors open 8 AM-1 PM; set-up at 6 AM. VE Exams. For reservations, send a check payable to *KMRA Swapfest, P.O. Box 411, Waukesha WI 53187-0411.* Please include an SASE with your order, or it will be held at the door.

OCT 29

CONNECTICUT The annual Ham Radio Auction, sponsored by Tri City ARC, will be held at the Senior Citizens Center, Waterford Municipal Complex. Set-up at 9 AM. Auction from 10 AM until sold out. Talk-in on 146.07/.67 Rptr. For info call *KA1BB, (203) 739-8016.*

MOBILE, AL The Mobile ARC will hold its Ham/Computer Fest at ABBA Shrine Temple, 7700 Hitt Rd., off Schillingers Rd., from 8 AM-4 PM. VE Exams start

at 9 AM: bring a copy and original of your current license, copy and original of current CSCE, two IDs (one must be a photo) and $5.75. Contact Louis AC4EN. Talk-in on 146.22/.82. Ragchew on 146.34/.94. For more details, contact *Richard Ireland KD4TTD, (205) 824-2749*, or write *M.A.R.C., P.O. Box 81791, Mobile AL 36689.*

OCT 29

PORT ST. LUCIE, FL The Port St. Lucie ARA "PSLFEST94" will be held from 0800 hours-1300 hours at Prima Vista Blvd. and Irving St. Talk-in will be on 146.955 (-) and 146.520 simplex. For details, contact *Bob Blackwell W3HVS, (407) 335-1341* or *Wes Sammis W2YRW, (407) 878-4739.*

ST LOUIS, MO West County Tech School is the location for the Ham Radio Club Hamfest. Time: 8:30 AM-2 PM. Talk-in on 146.34/.94. For details, call *Dave N0OFF or Joe N0SJR at (314) 230-9402;* or write to the club at *10 Ann Ave., Valley Park MO 63088.*

ST. PAUL, MN The Twin Cities FM Club will celebrate the 10th Anniversary of the Hamfest Minnesota & Computer Expo! The event will be held in the main arena at the St. Paul Civic Center, at Kellogg & West 7th St., from 8 AM-4 PM. For info and advance registration, write to *Hamfest Minnesota & Computer Expo!, P.O. Box 5598, Hopkins MN 55343*, or call the Hamfest Minnesota Info Line at *(612) 535-0637.*

OCT 30

DENVER, CO the 1994 RMRL Hamfest will be held by the Rocky Mountain Radio League, Inc., from 8 AM-2 PM at Jefferson County Fairgrounds, 15200 W. 6th Ave., Golden CO. VE Exams. ARRL Forum. Talk-in on 144.62/145.22 MHz. Contact *Joe Dickinson W.T0C, (303) 771-9577.*

LEBANON, IN The Boone & Clinton Co. ARCs will stage a Special Event at Boone Co. 4-H Fairgrounds, Warm & Dry Comm. Bldg. Flea Market. VE Exams. Talk-in on 147.105 and 443.150. Contact *Sam Paul WA9YZE* or *P.O. Box 186, Lebanon IN 46052.*

WESTMINSTER, MD The Radio Clubs of Carroll County MD and Penn-Mar PA will hold the 5th annual Mason-Dixon Computer/Hamfest at the Carroll County Ag Center in Westminster MD. Setup at 6 AM. Opening at 8 AM. VE Exam registration begins at 8 AM, pre-registration requested. Talk-in on 145.41 MHz. Contact *Gary Viands KE3FN, (717) 259-7342.* To pre-register for VE Exams, call *Page Evans NE3P, (717) 359-7610.*

SPECIAL EVENT STATIONS

SEP 30-OCT 1

ISHPEMING, MI The Hiawatha ARA will operate Station KB8DNS Sep. 30th 1700 UTC-0200 UTC, and Oct. 1st 1500 UTC-2000 UTC. This is to commemorate the 40th Anniversary of the Nat'l. Ski Hall of Fame; and the 90th Anniversary of the U.S. Ski Assn. Freq.: General phone and CW Novice on 80, 75, 40, 15, 20, 10, and 2 meters. For a certificate, send a 9" x 12" SASE to *Rod KB8DNS, 1740 Rosewood Ln., Ishpeming MI 49849.*

OCT 1

ALAMOGORDO, NM The Alamogordo ARC will operate Station N5SUM from The Intern'l Space Hall of Fame & Museum, in conjunction with the annual induction ceremonies. Operation will be from 1500 UTC-2300 UTC. SSB: 28.475, 21.375 and 14.275 +/- QRM. CW frequencies will be announced on the air. A station for satellite contacts is being planned. A QSL card picturing the Space Hall will be mailed to all 2 way/SWL requests received and confirmed. No SASE required. Address mail to *Intern'l Space Hall of Fame, ATTN: N5SUM, Route 2001 P.O. Box 533, Alamogordo NM 88311-0533.* Do not send requests to callbook address. For more info, contact *Bill Leehan N5SUM, (505) 437-9781*, or via *K5DI BBS in NM.*

ANAMOSA, IA The Jones County ARC will operate N0CWP 1500Z-2000Z, to celebrate their annual Pumpkinfest. Operation will be in the lower 50 kHz of the General subbands. For a certificate, send confirming QSL to *Jim McClintok N0CWP, Box 462, Morley IA 52312.*

RICHARDSON, TX The Alcatel ARA will operate N5TBQ from the Open House site of Alcatel Network Systems, Inc. Time: 1500Z-2200Z. Frequencies: General phone portions of 40, 20, 15, and 10 meters. For a QSL card, send contact report to *Alcatel Network Systems, Inc., AARA, M/S 401-212, 1225 North Alma Rd., Richardson TX 75081-2206.*

OCT 1-2

PITTSBURGH, PA The Breezeshooters ARC will operate Station W3XX 1400Z-2100Z Oct. 1-2, from the submarine U.S.S. Requin, docked at the Carnegie Science Center. Operation will be CW on 7.123 and 21.123, and phone on 7.250, 14.250, 21.350, 28.460, and 146.52. For a certificate and QSL card, send QSL and an 8 1/2" x 11" SASE to *Ron Berry WB3LHD, 326 Sunset Dr., Bethel Pk., PA 15102.*

OCT 8

SANTA ROSA ISLAND, FL The 30th Anniversary of Islands On The Air (IOTA) will be observed by the SHARC group of Pensacola, operating from Fort Pickens on Santa Rosa Island (NA-142), from 1300Z-2000Z. SSB and CW operations will be on 40, 20, 15, and 10 (Novice sub-band, conditions permitting), and on the IOTA call-in freqs. of 14.260 and 21.26o MHz, +/- 10 kHz. For a QSL card, send yours with QSO contact number given (enclose an SASE). Send to *N4MAD.*

SAYREVILLE, NJ Members of the Raritan Bay Radio Amateurs will operate /ABRA from 0000Z-2400Z to commemorate the 40th Anniversary of their

club. CW operation will be in the Novice CW sub-bands. Phone operation will be in the lower portion of the General phone sub-bands on 80-15 meters, as well as in the 10 meter Novice phone sub-band. For a certificate, please send a QSL and a 9" x 12" SASE to the callbook address of the station worked.

OCT 14-16

GREEN VALLEY, AZ The Green Valley ARC will operate KC7MF from 1600Z Oct. 14th-2300Z Oct. 16th, to commemorate the dedication of the Green Valley Titan Missile Museum as a Historical National Monument. Phone Bands: 3.860 (AM or SB); 7.230; 14.250; 21.330; 28.450 MHz. The local 2M Repeater operation will use 145.290 MHz(-600). For a certificate send QSL and an 8" x 12" SASE to *GVARC, 601 N. La Canada, Green Valley AZ 85614.*

WISCONSIN To commemorate its 3rd annual disaster-services seminar, SATERN (Salvation Army Team Emergency Radio Network) will sponsor Station WW9E. CW and SSB activities are planned for the lower portions of the General and Novice subbands. Digital activities are also planned. For QSL, please send your card, SASE, and name of operator worked to *NH2Z, Apt #608, 84-265 Farrington Hwy, Waianae Hawaii 96792*, or directly to operator contacted.

OCT 15-16

TABLE MOUNTAIN, CA The 4th annual "Mountain Top Mobile" will be conducted in the San Gabriel Mts. Operations will be in the lower portions of the 20 and 15 meter phone subbands, RS 12 satellite passes, and in the 40 meter Novice CW and 10 meter Novice phone subbands. Listen for "Mountain Top Mobile" moniker. For a certificate, send QSL and 9" x 12" SASE to *Ivan Hinkle N6PQB, 2121 E. Ave. I #70, Lancaster CA 93535.*

WESTPORT, MA The Westport Hams (WHAMS) will operate K1MYL on 15 and 16 Oct. from 1400 UTC-2100 UTC, to celebrate the 4th annual Westport Harvest Festival. Operation will be in the General portion of 80, 40, 20, 17, and 15 meter bands, and the Novice portion of 10 meters; and on 147.45 simplex. For a special QSL, send your QSL and SASE to *Leonard A. Moniz K1MYL, 43 Kirby Rd., Westport MA 02790.*

OCT 16

WARMINSTER, PA WA3DFU and the Warminster ARC will sponsor the "Almost Annual Delaware DX-pedition." Operation will be from 1200 UTC-2100 UTC. Look for them near 7225, 14275 and 28440; CW on request. Send SASE to *WA3DFU, P.O. Box 113, Warminster PA 18974.*

OCT 22

LYNCHBURG, TN The Alabama Goodtime Gang will operate WD4JDB from 1100Z-0000Z from the location of the 6th annual Jack Daniels Internat'l Invitational Barbecue Cookoff. Operation will be in the middle of the General phone portion of 80, 40, 20, 15, and the Novice portion of 10 meters. Packet frequencies will be 145.01 and 145.05. For a certificate, send QSL and a 9" x 12" SASE to *AGTG, P.O. Box 1624, Anniston AL 36202.*

YORKTOWN, VA The Williamsburg Area ARC will operate W4TMN 1200Z-0100Z to celebrate the 213th Anniversary of the surrender of Cornwallis at Yorktown in 1781. Frequencies: 28.350, 24.950, 21.350, 18.150, 14.270, 7.270, and 3.870. For an unfolded certificate, send QSL and a 9" x 12" SASE to *Michael Conte KD4HYT, 120 Crescent Dr., Williamsburg VA 23188.*

OCT 22-23

CRESCENT CITY, CA KA6SPO will operate Sat. and Sun. 1500Z-0600Z, to celebrate 102 years of the Point Saint George Light House. Operation will be in the lower portions of the General sub bands. A certificate and QSL card are available. Send an SASE to *KA6SPO, Bill Wortell, 110 Cannon Dr., Crescent City CA 95531*

OCT 29

PISCATAWAY, NJ AA2KS from Long Valley NJ will celebrate Halloween by operating a SE Station from the site of "The Ghost of Long Valley." Operation will take place on Oct 29th for 24 hours. Frequencies: General portion of 40, 20, and 15 meters, and Novice 10 meters. For a special QSL card, send QSL and SASE to *Piscataway ARC, P.O. Box 1233, Piscataway NJ 08854.* Sponsored by the Piscataway ARC.

OCT 31-NOV 1

BREVARD, NC The Transylvania County ARC will operate Station KD4ZY, from Transylvania County NC. Time: 2100Z Oct. 31-0100Z Nov. 1. Frequencies: 7.234, 14.295, 21.365, and 28.335 SSB; and 146.52 FM simplex. For a certificate, send a legal size or 9" x 12" SASE to *Willis B. Casey KD4ZY, 116 Campbell Dr., Pisgah Forest NC 28768.* Operation will be from the Devil's Courthouse on Blue Ridge Pkwy., weather permitting.

NOV 5-7

WICHITA, KS The Wichita ARC will operate W0SOE from the Wichita Boathouse. The Station will commemorate the world's first all female yacht racing team aboard the America 3. Operation will be on the final day of the World Cup yacht races. Time: Nov. 5th, 10 AM-5 PM; Nov. 6th, 1 PM-5 PM. Freqs. include lower portions of General phone subbands on 20 and 15 meters, and Novice phone subband of 10 meters (propagation permitting). QSL with SASE to *KD0AY, 1603 Fairview, Wichita KS 67203*

Number 26 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

This month will provide a mixed bag of conditions, and it appears that there may not be any constant conditions that remain the same for even three days in a row. You can expect almost constant changes in propagation, and it looks like the week of the 9th through the 15th will be the closest approximation to consistency from day to day for Fair-to-Good propagation. The *worst* periods will be the 3rd through the 5th and the 18th through the 20th (see the chart), and again on the 24th and 25th. The contest weekends won't be spectacular, but ought to prove Fair-to-Good propagation for you DXers.

10 and 12 Meter Bands

Occasional F-2 layer skip on Good days to tropical areas (South America and countries below the equator) during daytime hours. The band closes before local dark.

15 and 17 Meter Bands

Fairly good DX to Africa and Latin America from North America, and fairly good short skip out to 1,000 miles or so during the day. The band will close early and open late. Some grey-line DX is possible. The band closes shortly after dark.

20 Meter Band

This is *best* band of all for DX between sunrise and sunset to most parts of the world. On Good days you may find the best results in the mornings and afternoons, and occasionally long-haul trans-equatorial openings. There will be short daytime skip out to about 2,000 miles on Good days.

30 and 40 Meter Bands

DX can be expected between about sunset and sunrise on Good days . . . and even on Fair days. Signals from the east will peak between sunset and midnight local time, and from other directions between midnight and sunrise local time. Short skip out to about 1,000 miles during the daytime, and out to beyond 2,000 miles during the evening hours. The band "goes long" after sunset local time on both 30 and 40 meters. Some aspects of 30 are similar to 20, while other aspects are similar to 40. You'll just have to watch closely each day and night, paying attention to the WWV numbers at 18 minutes past any hour.

80 and 160 Meter Bands

You will find decent conditions between local sunset and sunrise on Good days (see chart) to DX areas of the world, with very short skip (300-400 miles) during the daytime, and to about 2,000 miles or so at night. I never had much luck on 80 around noon, but found late afternoon and early morning to be the best times during daylight hours. DX on these two bands is noise-dependent as well. Best results will occur at night when QRN levels are low, and on Good days per the chart. 160 works best when you use a vertical antenna to transmit and a Beverage or similar horizontal antenna for reception. There won't be any daylight skip on 160, but DX usually peaks around midnight and again about sunrise. Nighttime skip can be up to 1,000 miles (short skip) and over 2,000 miles (long skip DX) on Good days.

General Comments

Keep an eye on WWV daily; use Good days for best results; and do your operating when the static levels are low. See you next month. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20						20					15
ARGENTINA	20	40A	20	40					10		20A	20A
AUSTRALIA	20	40A		40	40	20	20	20		20	15	15
CANAL ZONE	40A	40A	40	40	40		20	20A	10	15A	20A	20
ENGLAND	40	40	40	40				15	20A	20		
HAWAII	20	20				20	20			15	15	15
INDIA						20	20	20				
JAPAN	20					40	20				15	15
MEXICO	40A	40A	40	40	40		20	20A	10	15A	20A	20
PHILIPPINES							20					
PUERTO RICO	40A	40A	40	40	40	20	20A	15A	15A	20A	20	40A
SOUTH AFRICA	40	40A	20					15A	15A	20A	20A	20A
U S S R	20	20					20	15			20	20
WESTCOAST	20A	20	40	40	40	40	40	20	15	15A	15A	15A

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20			15	15
ARGENTINA	20	40	40	40						15A	20A	20A
AUSTRALIA					40	40	20	20	20		15	15
CANAL ZONE	40	40	40	40	40	20	20	15	15A	15A	15A	15
ENGLAND	40	40	40	40				15	15	20A	20	20
HAWAII	20	20	20	40	40		20	20		15	15	15
INDIA	20	20					20	20				
JAPAN	20					40	20	20				15
MEXICO	40	40	40	40	40	20	20	20	20	15A	15A	15
PHILIPPINES	20A	20					20	20			15	15
PUERTO RICO	40	40	40	40	40	20	20	20	20	15A	15A	15
SOUTH AFRICA							10	15A	15	20A	20A	20
U S S R							20	20A	15	20	20	

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20A	20A	20			40	40	40A	20	20	20	20A
ARGENTINA	20A	20	40A	40						15A	15A	15A
AUSTRALIA	20A	20A	20	20	40	40	40		20	20	15	15
CANAL ZONE	20	20	40A	40A	40			20	20A	15A	15A	15A
ENGLAND			40					20	15	20A	20	20
HAWAII	15	20A	20A	40A	40	40	40	20	20	20		15A
INDIA	20A	20A						20	20			
JAPAN	20A	20A	20			40	40	40A	20	20	20	20A
MEXICO	20	20	40A	40A	40			20	20A	15A	15A	15A
PHILIPPINES	15			20		40	40		20	20		
PUERTO RICO	20	20	40A	40A	40			20	20A	15A	15A	15A
SOUTH AFRICA	20							20	20	15	20	20
U S S R			40	40				20A	15A	10	20	20
EAST COAST	15A	20	40	40	40	40	40	20	15	15A	15A	15A

OCTOBER 1994

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G-F
2 F	3 F-P	4 P-VP	5 P-F	6 F-G	7 G	8 G
9 G-F	10 G-F	11 F-G	12 G	13 G-F	14 G-F	15 F
16 F	17 F-P	18 P	19 P	20 P	21 P-F	22 F
23 F-P	24 P	25 P	26 P-F	27 F	28 F-P	29 P-F
30 F	31 F-G					

Number 27 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Judy Walker, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

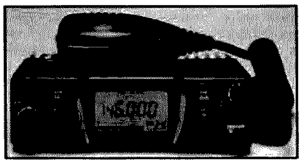
The deadline for the November classified ad section is September 8, 1994.

Continued on page 80

Number 28 on your Feedback card

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW



ICOM

Icom has introduced the IC-21H 2 meter mobile with receive capability on the 440 MHz band. By using this bonus band, hams can enjoy full duplex crossband operation!

You can automatically store your last 10 transmit frequencies in the scratchpad memories (five simplex and five duplex). This allows you to instantly recall recent operating information. Add to this the IC-281H's 60 regular memory channels and you have a very smart mobile rig.

Automatic memory channel advance enables easy programming. A TNC can be connected directly to the modulation circuit via the DATA jack. The IC-281H can handle 9,600 bps with no modification. Special circuit design prevents overmodulation during high data throughput. This rig is designed to handle high duty-cycle operation, such as packet, with high stability.

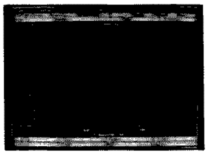
The suggested retail price is $462. Many options are also available. For more information, visit your favorite dealer or contact *ICOM America, Inc., 2380-116th Avenue N.E., Bellevue, WA 98004; (206) 454-8155.* Or circle Reader Service No. 201.

NUMBER ONE SYSTEMS

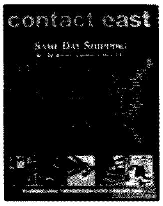
Until now, designing passive filters for use in electronic circuits has often been regarded as a black art. Your choice used to be limited to either complex mathematical problems or the error-prone manipulation of esoteric constants derived from tables.

Now Number One Systems has introduced Filtech, a new filter circuit synthesis program. Filtech gives the practicing design engineer or homebrewer quick and painless answers to filter design problems while encouraging experimentation and learning in an interactive manner.

Filtech is able to analyze synthesized filter circuits independently and display a graphic plot of the calculated frequency response, superimposed on the specified filter limits. The program can synthesize both active and passive filters up to sixth order with a frequency range extending from fractions of a hertz to over a gigahertz. It is priced at US $275. For more information contact *Number One Systems, 1795 Granger Avenue, Los Altos, CA 94024; (415) 968-9306.* Or circle Reader Service No. 204.



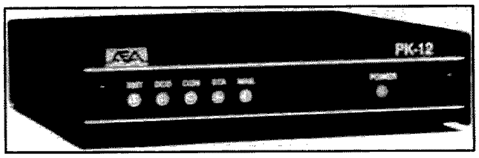
CONTACT EAST



The new Contact East catalog is now available, 244 pages filled with new test instruments and tools for engineers, technicians, and home-brewing hams. Quality products from brand-name manufacturers are featured for the testing, repairing, and assembling of electronic equipment.

Product highlights include new items: DMMs, custom tool kits, EPROM programmers, power supplies ELF meters, books, breadboards, scope meters, and precision hand tools. Also included are popular test equipment, soldering/de-soldering systems, static protection products, ozone safe cleaners, magnifiers, inspection equipment, workbenches, cases and more. All orders placed by 4 p.m. are shipped by 5 p.m. To receive your free copy, contact *Contact East, 335 Willow Street, No. Andover, MA 01845; (508) 682-2000, FAX (508) 688-7829.* Or circle Reader Service No. 206.

ADVANCED ELECTRONIC APPLICATIONS



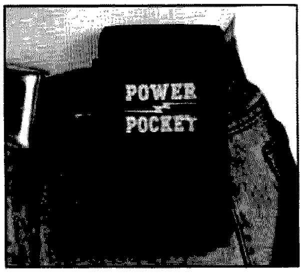
AEA has introduced the latest addition to its high-quality data controller line—the PK-12 Packet Controller. The PK-12 is a low cost, 1200 bps VHF/UHF packet controller designed for those hams who are just getting into packet radio, as well as for those serious packeteers who want a small portable unit.

The PK-12 comes with AEA's MailDrop feature, allowing users to automatically receive and reverse-forward messages and third-party traffic. The unit is a power saver as well, requiring less than 80 mA @ 13.6 VDC.

You don't have to spend time learning a huge command list with the PK-12. The command set can be be limited to the most-often-used commands. Just plug it in and get on the air!

The suggested retail price is $129. For more information, visit your favorite amateur radio dealer or contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554, FAX (206) 775-2340.* Or circle Reader Service No. 202.

NCG COMET



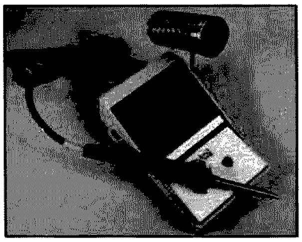
The new Power Pocket from NCG Comet is a convenient, compact slim design Yuasa battery providing a dependable 2 Ah of 12V power.

The lightweight (30 oz.) Power Pocket is enclosed in a comfortable soft case, which can be worn on a belt or with the included shoulder strap/hip belt. A standard cigarette lighter adapter plug inserts into the fused adapter socket, providing hours of extended operation.

The sealed-case lead-acid battery can be topped-off without the memory effects of NiCds. A 110 VAC wall charger is included.

The Power Pocket offers a good backup for your HT battery for emergency and extended use. For more information, visit your favorite dealer or contact *NCG Comet, 1275 North Grove Street, Anaheim, CA 92806; (714) 630-4541, FAX (714) 630-7024.* Or circle Reader Service No. 203.

THE TOOL RESOURCE



The Hexacon HTR 3320 soldering station is now available from The Tool Resource. This workhorse is designed with temperature regulation from 350 degrees F to 850 degrees F. The thermal compensating element increases the iron's output as the work rate increases.

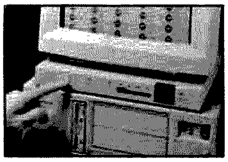
The HTR 3320 solders a wide range of electronic connections and multi-layer PC boards, making this a good choice for the workbench. There are no moving parts, ensuring high reliability and simple maintenance. It also accepts a wide range of surface-mount tips.

The price is $74.99. For more information contact *The Tool Resource, P.O. Box 1106, W. Dundee, IL 60118; Voice and FAX (708) 468-0849.* Or circle Reader Service No. 205.

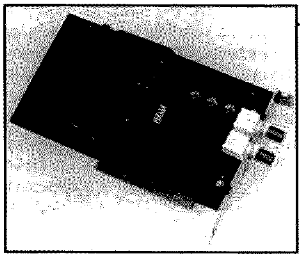
TRIPP LITE

The MasterTouch under-monitor surge suppressor from Tripp Lite offers features not found on any other console-style surge suppressor at any price. The unit features special diagnostic circuitry to warn of potential power problems before the equipment is turned on. Color indicators display power protection status plus wiring integrity of the outlet source. An exclusive brownout indicator signals the presence of dangerous low voltages that can damage equipment, allowing the user to power-down until the danger passes.

The MasterTouch Plus features FAX/modem protection. Both models feature an attractive low-profile design. They have ISOBAR surge suppression circuitry, with 1080 joules of spike protection at up to 54,000 amps. Superior noise filtering is also provided. Both feature a lifetime warranty and Ultimate Lifetime Insurance to protect connected equipment against surge damage, up to $25,000.



The MasterTouch has a suggested retail price of $139.95; the MasterTouch Plus has a suggested retail price of $149.95. For more information contact *Tripp Lite, 500 N. Orleans, Chicago, IL 60610-4188; (312) 329-1777, FAX (312) 644-6505.* Or circle Reader Service No. 208.



NOVATECH INSTRUMENTS

Novatech Instruments has introduced the Model DDS4 PC—a 34 MHz Synthesized Signal Source on a PC Card for use in PC XT and PC AT, or later ISA bus computers. The DDS4 PC Direct Digital Synthesizer provides 10 ppm/year stability and excellent spectral purity for an economical price. It can generate sine and TTL clock signals simultaneously from 5 Hz to 34 MHz in 0.02 Hz steps.

By using the latest digital technology, it achieves spectral purity comparable to that of older instruments costing many thousands of dollars.

The DDS4 PC comes with a C language program that runs under DOS and makes it easy to set frequency and attenuation or to sweep through a set of frequency, attenuation, or dwell time settings. The DDS4 PC is priced at $550. For more information contact *Novatech Instruments, Inc., 1530 Eastlake Ave. E., #303, Seattle, WA 98102; (206) 328-6902, FAX (206) 328-6904.* Or circle Reader Service No. 207.

73 Amateur Radio Today

NOVEMBER 1994
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73 Amateur Radio Today

November 1994
Issue #410

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REVIEWS

How about a packet modem with a price so low you'll have to sit on the floor to use it? Turn to page 42.

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to 73.

On the cover: Here is how Jose Rivera KP4FMD camouflaged his Eagle DX-VI Gap antenna, using plastic vine. The antenna is practically invisible from the street. (A one-year subscription extension goes to KP4FMD in the 73 photo search. TNX.)

FB

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Contract: As a *73* reader, you are hereby ordered to start your ham radio holiday shopping early. You'll find some great gift ideas in these pages, so get into that spirit of the season!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

When I Started . . .

. . . publishing articles about 2-meter FM and repeaters in *73* back in 1969, I met with massive resistance from the readers. It took about a year, a couple hundred articles, FM symposiums, which I organized around the country, a repeater atlas, and my publishing several books, to get repeaters launched. It takes a bunch of priming to light the fire under the spirit of adventure.

. . . and we have endless adventure available in amateur radio. It was the same thing when I began publishing tons of articles on sideband. Sure, today sideband and repeaters are common, but it took the work of many pioneers to make that happen. And those pioneers had the time of their lives out there on the fringes of the known ham world exploring the then unknown. They're the ones who hacked out the underbrush for our ham highways of today.

The first ham I ever met, as I mentioned in an editorial recently, was Harry Stevenson W1CUN, who was a 10 meter pioneer in my home town of Bethlehem, NH. As a publisher I've had the priviledge of knowing many of the great ham pioneers. Like Copthorn Macdonald, the chap who brought us slow-scan. And Sam Harris W8UKS-W1FZJ-W1BU, who invented the parametric amplifier and helped popularize moonbouncing. And John Williams W2BFD, the father of ham Teletype.

Though I'd talked with him for several years on the air, I first met Sam in 1951 when I moved to Cleveland. Sam had built the cellar for a new home (he and his family were living in it) and a 170' tower. I was working as a TV director at WXEL and was active mostly on 75m. I spent a good deal of time visiting Sam. Then, when he moved to Boston, I stayed at his house several times to talk VHF with him. When I took over as the editor of *CQ* in 1955 I got Sam to do the VHF column.

Sam had a psychological problem. He *had* to have the loudest signal in the world on any band he was on. This made moonbouncing on 2m a cinch for him. I think he was running 12 elements on 20m, just to make sure no one could be louder. He lived way out in the woods in Medfield, far from any neighbors, so his PP-1000-T final amplifiers for each band running who knows how many kilowatts didn't cause much TVI. They did have to shut down the FCC monitoring post in the next town (Millis) when he was operating. He wiped 'em out.

When I set up my station 2,500 feet up on Mt. Monadnock in southern New Hampshire, with an AM kilowatt on 2m and a 336 element beam, I put out a stronger signal than Sam, so that drove Sam not just off 2m, but out of the country. He moved to Puerto Rico and set up to use the 1,000-foot Arecibo dish for moonbounce. He did whatever it took to have the loudest signal in the world.

John Williams was another nut case. He got an exclusive contract to dispose of Ma Bell's retired Teletype machines and sold them to hams pretty much at cost. He developed all the early RTTY circuits. I spent a lot of time visiting him in his radio repair store in Woodside, Queens (NY). He's the one who got me hooked on RTTY, and that was what eventually got me started in publishing. He and I set up the first repeater in New York on top of the Municipal Building, allowing RTTYers for a hundred miles around to work each other on 2 meters.

Then there was Jack Babkes W2GDG, who lived a few blocks from me in Brooklyn. He's the guy who came up with the idea of narrowband FM. I met him in 1946 and immediately started converting my transmitters so I could help pioneer NBFM. Once Jack got the FCC to accept NBFM he went into business with Sonar Radio and made zillions. Today most of our VHF and UHF hamming is via NBFM. Thanks Jack.

Have all of the frontiers of amateur radio been conquered? Not by a long shot! There are endless possibilities for developments. All you have to do is get interested in some subdivision of the hobby and you'll find uncharted territory wide open for anyone with the spirit of adventure.

We're sending gorgeous color photos by slow-scan now, but by applying some of the newer data compacting algorithms and technologies, you could help speed photo communications and improve picture quality. And who knows, you might *even have* some latent unfulfilled desire to help others have fun doing this and start writing a series of articles for me to publish. Maybe a column. Maybe a book. That's what I did when I got interested in RTTY. First I started a newsletter, then a column in *CQ*, and then a book.

I was very sorry to read my old friend Lloyd Colvin W6KG recently passed away. He and his wife Iris W6QL have been the most prolific DXpeditioners of all time. The only big disappointment for me was that they didn't write much about their adventures. Believe me, every DXpedition *is* an adventure. I've operated from some weird spots, and every one has been exciting.

But then I've known all of the major DXpeditioners pretty well. Don Miller W9WNV, Gus Browning W4BPD, Dick McKircher WØMLY, Danny Weil VP2VB and his Yasme, and so on. I published some great stories of Gus' adventures. Ditto Danny's. Dick, as far as I know, pioneered the concept of signing rare country calls without actually going to the trouble to go to them, a technique which Don later developed into an art form. Like claiming to be on Heard Island while actually operating from north of Vancouver, the antipodes.

If you'd like to get involved with repeaters, we really don't have much need for just another repeater. There's a ton of 'em, and most are only being used a little of the time. But how about setting up a crossband repeater system? In on 2m, out on 6m, 220, 450, 1290, or perhaps 10m, 15m, or 20m, complete with remote tuning and beam turning? Let's get creative! I used to have a ball hooking up 75m roundtables with rare DX on 20m, relaying the round table to the DX station, and vice versa. Yes, that takes two rigs. You mean you don't have two rigs? Lordy!

Between packet, ham satellites, foxhunting, spread spectrum, slow-scan, and so on, there are endless areas for exploration and adventure. How about pioneering a modern counterpart of the Antique Radio Relay League's traffic system. But instead of passing worthless messages at 10 wpm and making endless errors, how about setting up a 25,000 wpm error-free message system which can scan in messages, establish the right routing automatically, and confirm the delivery?

If you decide to be adventurous and tackle something new in amateur radio, I'm going to be very upset if you don't keep a careful log of your adventure and give me a chance to get others excited by publishing it.

One of the airlines has a special on visiting Pacific Islands . . . only $150 per island. I sure wish I had the time to pack a rig and a couple antennas and put some of those rarer spots on the air and liven up our un-sun-spotted bands. I've operated from a lot of rare spots and I'm a skinflint when it comes to travel. It doesn't have to cost a bundle, as anyone who's read my travel adventures will tell you. I've got a few of my trips written up if you're interested in how cheap someone can travel. My *Uncle Wayne's Hawaiian Adventure* last year (24 pages) is $3. My *Uncle Wayne's Trips* to Russia, London, St. Pierre, Munich, Vienna, Krakow, and Prague (52 pages) is $5. My *Uncle Wayne's Caribbean Adventures* (96 pages) is only $7.50. They're available from Uncle Wayne's Bookshelf (800-234-8458). One of these days I'll put them all together into a book.

I almost forgot, my *Submarine Life in WWII* (76 pages) is $7.50. It's not very hammy, but it's exciting reading. And there are still a few copies of my book, *We The People Declare War On Our Lousy Government* for $10. A special thanks to all of you who've bought the book and written to tell me how much you've enjoyed it. Now get busy and start changing things.

There's nothing like taking on a new challenge in the hobby to get your juices going. You'll learn more, and you'll have tons of fun. When I think back over my years of hamming, I think first of the most exciting times. Putting up that repeater antenna on top of the Municipal Building at night, in a snowstorm, on a steep copper roof. Installing a 16-element 2m beam on top of The News building on 42nd Street, where I had to walk on a narrow ledge with a 30-story drop to put it and its rotator in place. Making 10 GHz contacts from on top of a New Hampshire mountain in the freezing cold at night to get a new state. The excitement of operating from Navassa Island and two close calls with death on the trip. Almost getting killed in Kenya by Somali tribesmen while visiting 5Z4ERR. The fun of making the first coast-to-coast 80m RTTY contact. Walking around Peterborough with an HT making 20m DX contacts via a 2m repeater. Working moonbouncers all over the world on 1296 MHz from the big dish at Arecibo. Working my own home station on 20m and 75m from Australia and hearing it S9++ on both bands. Also working it from Beirut, Damascus, Kabul, and Katmandu. Wow!

Continued on page 76

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Tony Burton, Calhoun GA Wayne, it was with a great deal of interest and head-nodding that I read your editorial in the June '94 issue of *73*. While I do not yet have my own ham license (I am working on the "&$##!@! code), I do have my GROL from the FCC, and was the ship's MARS officer on my last ship. I've made a lot of patches and sent quite a few MARSGrams.

Let me first say that, technically, I feel that I could sit for the test elements up through at least Technician or even General with little or no preparation. After 12 and a half years as a Navy electronics technician, being a Navy instructor of electronics, almost two years as a satellite communications field engineer, and teaching electronics at both the junior college and high school level, this isn't a problem for me.

And, I do understand the need for my knowledge of the rules and regs. So, I study. But I'm darned if I really understand the need for CW! Oh, sure, I have heard the arguments about how it is the most reliable, last-ditch form of communication to punch through static and so forth, but why make it a *requirement?*

As you so clearly stated, it is an anachronism. It is like requiring hams to be able to calculate the proper biasing resistance values for a particular twin-pentode from memory, without use of a calculator, just in case they ever needed to be able to do it.

After all, most people who send and/or copy code anymore don't *really* pound brass—they tap on a keyboard, and send it out all neat and clean and edited from their PC. And, when copying, they simply read it from the screen of their computer, which is hooked up to their rig. I guess sending and receiving CW *could* be fun. But if it was all that much fun, wouldn't it be something reserved for Extra Class? Even the Navy and other military forces have all but abandoned the requirements for their operators to be able to copy Morse!

So, until the FCC changes the requirements, I will continue to listen to the code prep tapes that WB6NOA has produced. But, considering the trouble I am having with code now, don't expect me to ever get past Technician Plus. At this point, at least, I think I have better things to do with my time.

While I'm on my soapbox, let me address another issue that you brought up—school clubs. I am now a Technology Education teacher at a small rural high school. This is only the second year of the program at my high school, so I am trying to get it rolling.

I told my students about my experiences as a MARS officer, and some of them seemed very interested. So, I began considering the idea of incorporating ham licensing into the curriculum for the second year, which is, appropriately enough, Communications Technology I and II. I felt that if a kid could walk from a semester-long course with not just a letter grade but with a ham license, that kid would have a lot more pride and feelings of ownership in the educational process. But, my budget has been cut by $500 for the coming year, and it wasn't a big budget to begin with.

I wrote letters to some manufacturers, asking them about the possibility of donations, even of old or refurbished equipment. I haven't had any positive answers yet, except for one company which said they would give discounts to educational institutions buying their equipment. I have put notices on a couple of local computer BBSs where I know some hams hang out, asking them for their ideas or donations. No luck yet.

What is it with these companies? Is their business so good that they don't want anything that will (1) build good PR for their company; (2) build a strong association of their product name with these potential hams because it is what the kids use at school (and if you don't think this works, ask the folks at Apple Computer); or (3) encourage the entry of new blood into the ham field? As you said, are they content to simply log in the Silent Keys? It is simple: New users buy equipment. And, even if they buy someone else's used equipment, that means that the previous owner now has the money to buy that new TNC or whatever he has been wanting.

Well, I know I will be setting up my own personal ham shack this fall. I have been doing some extra work this summer to make the money for it (you know what teacher's salaries are like). And, I can tell you for sure, it will be a cold day in Havana when I buy any equipment from a manufacturer that doesn't at least offer reduced pricing to educational institutions.

Tony, you're right about the code. But on getting free gear or discounts, you are like many teachers, short on salesmanship. When you want to sell someone something, you put yourself in their chair and see if you can convince yourself. I'll bet you won't. The ham manufacturers get a wastebasket full of requests for free or discounted equipment every week. A big wastebasket. Every DXpedition thinks a rig and antennas should be donated for the PR involved, as do schools, clubs, a hundred hamfests, a dozen conventions, the handicapped; they all are banging on their begging bowls for handouts. Gets old. You'll get more enthusiasm if your kids have some goals to work for . . . like setting up a club station. It's a challenge to see how much they can do with how little. And then they'll have something they've worked for and can be proud of. The manufacturer's margins are thin in the ham business, and dealers get all bent out of shape if a manufacturer sells direct to the customer. And when they're bent, they talk down the gear and talk up the competition, so being nice guys and giving your group a discount could poison the well for the manufacturer . . . Wayne

Jim Oss AAØPP, Junction City KS Dear Wayne and Phillip Kawa (September 1994 "Letters" column): As a former Coast Guard radioman, I have to say that they had a most effective code-learning method—negative reinforcement; i.e., if you didn't come up to code speed by the weekend, you didn't go on liberty.

Dennis D. Powers AB6QR, Forest Ranch CA I doubt if I can qualify as an "old geezer," as WD9HXH prefers to call CW operators (August 1994 "Letters" column). I guess being only 42 years of age makes me a middle-aged geezer. But I have to wonder if in pointing out that 50 years worth of sending by CW could be accomplished in a mere 3.38 minutes by using "modern technology," he happened to give thought to a couple of minor considerations. First, before you can send out that glorious burst of speedy little megabits you have to do a little typing, which in some cases might take some folks all of 50 years! Secondly, did he ever consider that there are those of us who enjoy a nice, relaxed chat? I would hardly call 473,364,000 words in 3.38 minutes a nice leisurely chat!

The requirement that access to the HF bands is limited to those who have demonstrated at least the ability to pass a 5 wpm CW test is in the best interests of amateur radio. And the requirements for passing higher-speed tests for higher-class licenses serve the same purpose. Ultimately, these requirements help to ensure that those who will be operating in the HF bands will have demonstrated some *commitment* to both themselves and the hobby. For amateur radio to maintain its high standards, we need to ensure that only those who have commitment to both themselves and the hobby are welcomed into our ranks.

Bill Martin N7EU, from the 73 BBS I think the quality of the magazine has really been improving. I enjoy the fact that *73* magazine provides us with a lot of really neat projects for the homebrewers. Very interesting and valuable articles. I really like Mike Bryce's articles and columns about QRP, and his reviews on kits and projects. Keep up the good work.

Gene Shannon, Colorado Springs CO Wayne, I read your blurb on artificial lighting ("Is Artificial Light Making You Sick?") in your March editorial and can't help but make a response to a comment you made.

First, I couldn't agree with you more on your opinion about the results of artificial light on our lives—just like so much else that we use from the artificial realm in our day-to-day living. We, indeed, need to watch the research in this area—assuming we can get some *real* scientific study in the area, and not some of the global warming type of garbage!

I don't want to turn your good magazine into a theological treatise but, in the interest of "fair journalism," a statement in your third paragraph concerning those "intellectually stunted by religious fundamentalism or watching too many sitcoms" deserves discussion. Then you tie that into the evolution theory bit as if it were fact.

I must agree with you that the sitcoms will certainly stunt one intellectually, but I would also add, stunt one emotionally and morally! The real "stinger" to me is how a person of your intellectual prowess can come up with your statement on evolution—as if it were the truth! Even Darwin himself, in his book *Origin of the Species*, was puzzled by the fact that no "transitional forms" had been found. He asked, "Why . . . do we not everywhere see innumerable transitional forms?" (*Darwin on Trial*, Dr. Phillip Johnson, page 47). And today, after more than 135 years of all kinds of research, still no "transitional forms" have ever been found. I'll bet you can even imagine why not. To me, the probability (likelihood) of all creatures having evolved from some "mass of slime" takes much more faith than to believe in a Creator. (The mathematical probability of such occurring is pretty phenomenal as well.)

Back to the artificial light topic—I can only add that I feel that your conclusions concerning the adverse affects on people is having the same results on we who created it as it has on those who believe they evolved. We both need to take the proper precautions. Otherwise, keep up the good work.

P.S.: Do you suppose the increase in crime, drug usage, abortion, and other social ills might be related to the propagation of the "we are animals" syndrome and have no One to be accountable to? I can see a correlation.

Gene, I'm aware of the weaknesses in Darwin's theories, but for the most part they have been proven. On the matter of the lack of transitional forms, I like the Hoyle-Wickramasinghe theory the best, as I've mentioned in my past editorials. I hope you take time to read their books, which are scientific marvels.

As far as a "Creator" is concerned, sure, perhaps. We're just too ignorant so far to know about that other than by speculation (guess). But I've seen no sign yet of a creator who is messing with our lives on a daily basis, or who rewards or punishes. Again, I like the Hoyle approach, which makes a very good scientific case for any Creator (and life itself) probably predating the start of our universe.

Hey, if there is a Creator, how did it get created? Yes, I know, it's turtles all the way down. . . . Wayne

Marconi's Widow Dead at 94

The widow of Guglielmo Marconi has died at age 94. The Marchesa M. Christina Bezzi Scali died July 15, 1994. The couple was married In 1927. Marconi died in 1937, 10 years after his wedding, at age 63.

The couple is survived by a daughter, Elettra, who was baptized by Cardinal Eugeni Pacelli, who would later become Pope Pius XII. Elettra's Godmother was Elena di Savoia, Queen of Italy.

According to Pat Ciancarini IØKHP, Elettra will continue to work in preparation for "1995, Year of Guelielmo Marconi," the centennial celebration of Marconi's first wireless telegraph. *TNX QCWA News, Vol. 36, No. 9, September, 1994.*

GB2SM Now Obsolete

According to Britain's *Short Wave Magazine*, a shock announcement has come from London's Science Museum that the museum's amateur radio station will officially close down operations on November 7. The comprehensive station, which features satellite fax, and RTTY mode reception capability is now considered obsolete.

Speaking on behalf of the museum, Graham Farmelow, Head of Education Interpretation, said, "The station exhibit no longer reflects the contemporary image of modern communications required by the broader audience attending the museum." The amateur radio station section of the display has used the famous callsign GB2SM for nearly 40 years, and has served as a sort of international ambassador.

The space currently occupied by the exhibit will be turned over to a display relating to data communication superhighways—a phenomenon which was pioneered by hams! The move is seen as a loss to the amateur community worldwide. Comments can be directed to *Sir Neil Cossons, The Science Museum, Exhibition Road, London SW7. TNX Short Wave Magazine, Vol. 52, Issue 9, September, 1994.*

FCC On the Move

The Federal Communication Commission's Washington headquarters will be moving from its present northwest downtown location to southwest Washington, DC after all. An agreement between the General Services Administration and "The Portals" has been reinstated by an appeals court.

The US Court of Appeals ruled that the GSA as the federal leasing agent had improperly terminated the lease in 1991 after FCC officials turned thumbs down on the move. The commission had argued that the leased space was inadequate to accomodate their needs and they did not want to leave the fashionable business area which was more convenient for communications industries representatives.

The GSA has now re-signed the lease with "The Portals" (which is still far from completed) and is scheduled to eventually move all of their administrative offices some two miles south. It could take six to eight years for the move to be completed. "The Portals" is on the Potomac River between the Washington Monument and the US Capitol. The lease will cost taxpayers about $15 million annually for 440,000 square feet—about $34/square foot. Word is the FCC is not giving up the fight to remain where they are. *TNX W5YI Report, Vol. 16, Issue 17, September 1, 1994.*

ORACLE Calls for "No Code—Worldwide"

Manditory Morse Code testing for any class of ham radio license, anywhere in the world, will be a thing of the past if a new campaign succeeds, according to a story in the *Westlink Report*. The Organization Requesting Alternatives by Code-Less Examinations, hopes to make its "ORACLE" acronym a household word by the time of the next World Radiocommunications Conference.

ORACLE is a newly conceived international organization based in Wellington, New Zealand. Its mission is to do away with the requirement for knowledge of Morse Code as a prerequisite for obtaining a ham license anywhere in the world. Rather than working with the various nations' amateur radio societies, ORACLE is bypassing them in favor of national and international regulators. Many of the radio societies are in favor of keeping the manditory code testing, but it will be the regulating bodies who will decide the fate of these exams.

You can contact ORACLE by mail at *Organization Requesting Alternatives by Code-Less Examinations, 90 Campbell St., Karon, Wellington, New Zealand, Att: Bob Vernall ZL2CA. TNX Newsline, W5YI Report, The Vernall Report, and Westlink Report, No. 679, August 31, 1994.*

Russian Space Pact

According to *Newsline*, Russian and American amateurs who flew aboard the space shuttle Discovery on last winter's STS-60 mission benefitted from temporary third party reciprocal operating agreements finalized just before lift off.

On February 3, the US Department of State and the Russian Ministry of Post and Telecommunications each approved the temporary arrangements, which allowed cosmonaut Sergi Krikalev, U5MIR, to contact the House of Science and Technology for Youth in Moscow on February 6. The contact was retransmitted in Russia on HF and VHF, according to the ARRL SAREX Working Group. After the Russian Ministry of Post and Telecommunications and the US State Department approved the arrangements, it was still necessary to obtain a Special Temporary Authorization from the FCC. The ARRL contacted the FCC's Personal Radio Branch, and the STA was granted on February 4. Permanent reciprocal operating and third party agreements between the US and Russia have been bottled in negotiations for several years. *TNX Newsline, Austin Amateur Radio Clubs' AARC/Over, August, 1994.*

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can reach us on compuserve at ppn 70310.775; on the Internet at address 70310,775@compuserve.com; or at the *73* BBS at (603) 924-9343 (2400-9600 bps), 8 data bits, no parity, one-stop bit. News items not published in *73* often find their way into our sister publication, *Radio Fun, a* special monthly magazine for new hams. You can also send news items by FAX at (603) 924-9327.

Number 4 on your Feedback card

An Average and Peak Reading RF Power Meter

Add this handy monitor to your operating table.

by Marion D. Kitchens K4GOK

Analog meters used as RF power output meters usually show relatively little average power output on SSB, especially as compared to keydown output. This often raises questions about proper equipment operation, especially when the owners' manual specifies "100 watts PEP" and the analog meter is reading considerably less. Too much mike gain and over-driving are often the result, with splatter across the operating band. The true power output during normal, everyday operation is often an unanswered question.

Measuring the peak and average power can be important. Two different rigs were returned to the dealer for replacement because on-the-air reports were of considerably less signal strength than comparable rigs, even though the key-down power was the rated value. Under a similar situation with a third radio, the problem was resolved by using a different type of mike on the radio. These problems originated because the operator's voice frequency content and the radio audio processing were incompatible. Attempts to resolve these problems by measuring power levels with existing RF power meters proved unsuccessful because they were much too slow to follow the audio voice peaks.

The meter described here is designed to answer just such questions and to serve as a routine, everyday operating aid. It employs a remote sensor unit with a separate display that shows both average and peak RF output simultaneously. The output display unit can be used on the operating desk with the sensor unit out of sight under the operating position. The meter is left in the line and thus provides continuous indication that the transmitting equipment is operating normally. Abnormal readings may also indicate high SWR on the coax line.

The meter is easy to build, and uses readily available components. It is simple enough to be built on perfboard. No special, tricky, or sensitive adjustments are required.

Photo A shows the assembled meter with an analog meter and a 10-LED bar display. Average output power is shown on the analog meter and peak power output is shown on the LEDs.

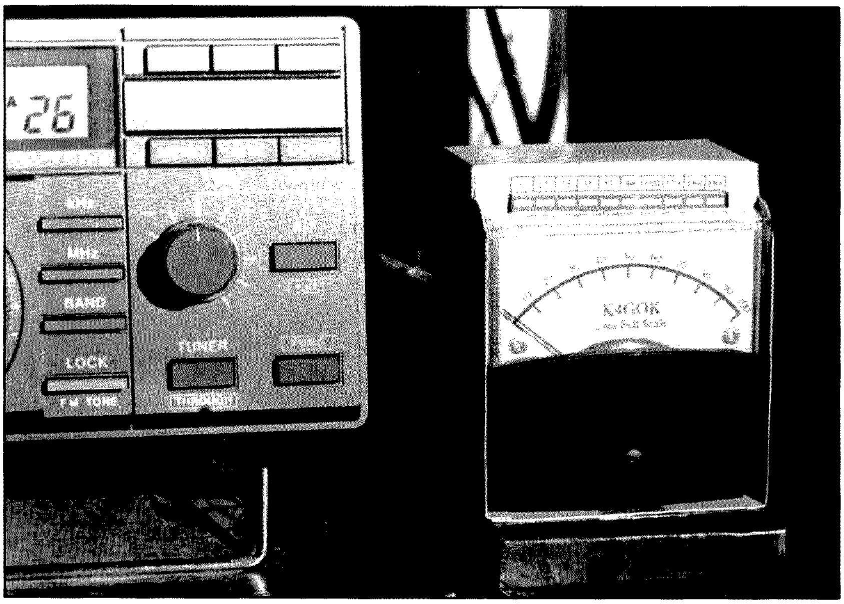

Photo A. The Peak and Average RF Power Meter.

The Circuit

RF is sampled by a resistor divider and rectified in the remote sensing unit. The resulting signal is applied to two sections of an LM3900 op amp. One section of the LM3900 drives the analog meter and the other section drives a National Semiconductor NSM3916 module. The internal damping of the analog meter provides a good measure of the average RF power. The fast response of the LEDs follows voice peaks and provides a good indication of the PEP power. The LM3900 was selected because it operates easily from a single-ended power supply and was on hand in the parts box.

A 100-watt transmitter could drive the analog meter directly, but the op amp allows adaptation to other power levels if desired. In one case it allowed me to use an existing resistor divider located inside the cabinet of a transmitter (32 sheet-metal screws would have had to be removed and reinstalled to make a change to that resistor divider!)

One section of the LM3900 drives the 1 mA meter through a 10k calibration pot. The 10 LEDs are part of a National Semiconductor NSM3916 module purchased at a local hamfest. The second section of the LM3900 drives the NSM3916 module through a second 10k calibration pot. Note the 0.1 cap and 1M resistor connected to the NSM3916 module at pin 6. They provide the correct time constant for easy visibility of the LEDs as they follow the voice peaks.

Figures 1, 2 and 3 show the schematics. Figure 1 shows the display and control circuits; Figure 2 shows the RF sampler schematic. An alternate schematic for the NSM3916 module is shown in Figure 3. The values shown are those used with a transmitter with 100-watt output, and were selected

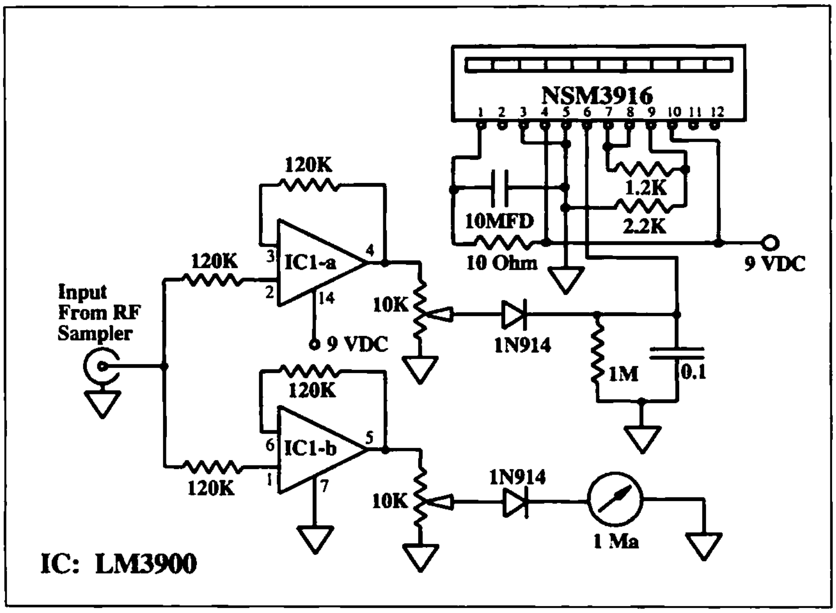

Figure 1. Schematic of the RF Power Meter.

because they were on hand and provided the desired performance. Other values could be substituted for the 120k resistors without problems, as long as both the input and feedback values are the same. The circuit as shown should work well with only a few watts of RF power by adjustment of the calibration pots and an appropriate RF resistor divider in the remote sensor unit. Don't hesitate to make changes in RF sensor box resistors to get the desired performance. And don't be surprised if the resistors used are frequency sensitive. The resistors shown in Figure 2 provide about 100 to 1 voltage division at DC, but about 10 to 1 at 50 MHz, suggesting that some of the "carbon composition" resistors are actually metal film types!

The RFC shown in Figure 2 should be selected for the band in which the power meter is to be used. Use 1 mH for HF, a Z50 for 6 meters, and a Z144 for 2 meters.

Construction

The recommended construction is simple and straightforward. It makes use of the NSM3916 module and perfboard. Fixed resistors are mounted directly on the module to fix the LED brightness and its voltage range. The other components are mounted on perfboard, except the RF sampling divider and RF rectifier diode, which are mounted in the remote sensor unit. The output from the sensor unit is fed to the indicator unit via RG 175 coax cable. The perfboard was mounted directly to the analog meter terminals. The NSM3916 module was mounted to the upper back of the analog meter using double-sided foam tape so that the LEDs are visible over the top of the analog meter.

Calibration

Calibration is best done with a known RF power source and an accurate RF power meter. A relative power scale can be obtained with a variable voltage source and a voltmeter. A Bird wattmeter can be used to measure the output of a transmitter at a known power level, say 100 watts, into a dummy load. (Use a dummy load to prevent QRM on the bands, please!)

First, set the pots to the low end of their range and apply 9 VDC or 12 VDC regulated power to the meter circuit. Next, apply the known RF power (key down) to the input and adjust the appropriate calibration pot for a full-scale reading on the analog meter. Then adjust the other calibration pot so that the #7 LED lights. Switch to SSB and verify that LEDs #8, 9, and possibly 10, light on voice peaks. The calibration pot can be adjusted later to obtain the desired LED display on voice peaks. It is recommended that the adjustment be such that the #10 LED does not light under normal operation conditions so that it can serve to indicate overdriving, or abnormal operation.

Labeling each LED to indicate peak power levels in watts requires a variable RF source or controllable voltage source and a voltmeter. If you have an accurate wattmeter, you can slowly increase the transmitter output, note the power as each LED lights, and label them accordingly.

In the absence of an accurately known RF power source, the meter can be calibrated in a scale showing relative power levels. For example, I recommend that LED #7 be used as 100 watts, and the remaining LEDs be labeled in terms of power relative to that. Using a variable voltage source and voltmeter, connect the variable supply to the input of the display unit, in place of the input from the remote sensing unit. Set the 10k calibration pots to mid-range. Slowly increase the voltage and record the values at which each LED lights. When the #7 LED lights, adjust the correct calibration pot so that the analog meter reads full scale. Calculate the power level for each LED for each of the recorded voltages by using the formula below. First calculate "K" as follows:

$K = 70.71/V_{\#7}$

Then calculate the power for each LED:

Power = $(K \times V_{LED})^2/50$

You can make a label for the analog meter in a similar manner if desired. The analog meter shown in the photo was not calibrated with an RF power scale.

Conclusion

The peak and average reading RF power

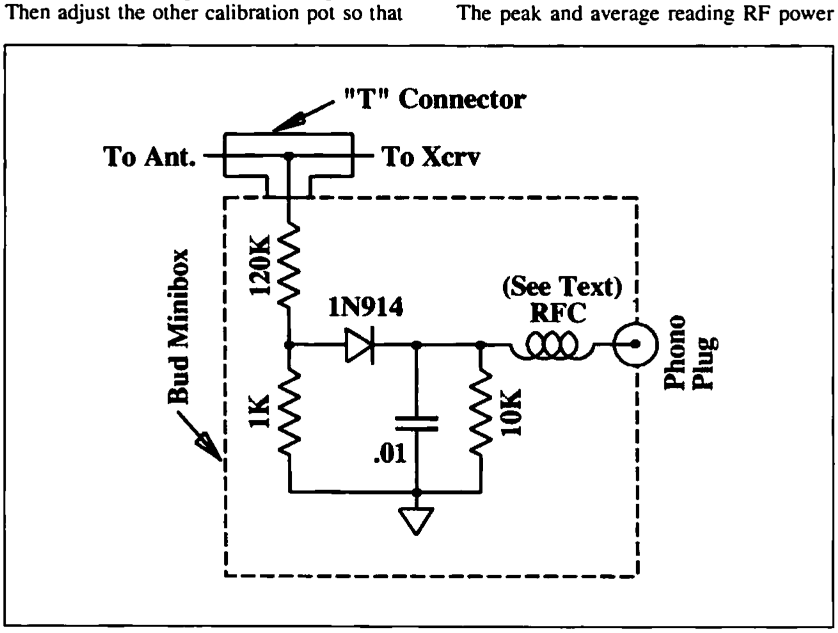

Figure 2. Schematic for the RF Sampler.

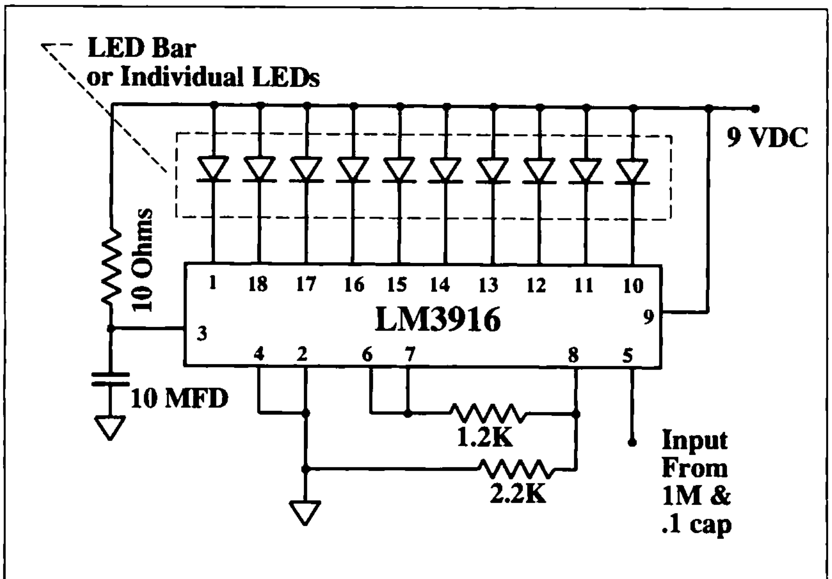

Figure 3. Schematic for an alternative to the NSM3916 module.

meter has been in use at this QTH for many years. It has been a valuable asset and a real "hassle-saver." It has proven reliable and a steady indicator that the solid-state "brick" I use on 6 meters is performing normally.

Readers are encouraged to build this simple power meter and enjoy the comfort of knowing that "all is well" while operating.

Drilled and etched PC boards for this project are available for $4.50 plus $1.50 S&H per order from Far Circuits, 18N640 Field Court, Dundee, IL 60118. Please specify either the NSM3916 or LM3916 module. Artwork for etching your own board is available by sending SASE to *73*.

73 Review

Number 5 on your Feedback card

by Steve Katz WB2WIK/6

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Amateur Radio Products Group
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Telephone: (310) 639-5300
Price Class: $1,210

The Kenwood TS-60S

50 MHz all-mode transceiver.

When Kenwood introduced the TS-50S all-mode HF transceiver a year ago, there were a lot of justifiable "oohs" and "aahs" from the amateur radio world. The TS-50S is the smallest, lightest full-powered (100W output) all-band (160-10 meters) full-featured HF transceiver ever offered to the commercial market. A number of VHF enthusiasts proclaimed, "If only it covered 6 meters, I'd buy this rig in a minute!"

I don't know if Kenwood ever considered trying to add 6 meters to the TS-50S, but they did come up with another solution: the TS-60S, which is the same size and has the same features as the TS-50S, but covers the 6 meter amateur band only. The TS-60S is priced at $1,209.95 (suggested list price), so not every 6 meter user will run out to buy one, but the rig is special in a variety of ways that may make it a good deal for VHFers. And its only serious competition, the Icom IC275H (similarly rated and featured, but covering both 6 and 10 meters), costs even more at $2,021 (suggested list price).

Having been active on 50 MHz since 1966 (Egad! 28 years now!) and having "grown up" with 6 meters from the AM days to SSB and FM repeaters, I feel particularly qualified to review equipment for this band. Already owning lots of 6 meter gear and not wishing to shell out over a kilobuck on an experiment, I was among those who didn't rush right out to buy a TS-60S, but a friend of mine, Chuck Armstrong KD6EQW, did. In fact, when he went to buy one, there was exactly one TS-60S in the entire country that he could find for sale from a distributor, so he bought it immediately, before it disappeared. In speaking with Jon KA6ZBI, the manager of the local HRO store (who is also a 6 meter enthusiast), I found that the rig is so popular he literally can't keep any in stock. This review is based on Chuck's radio, having serial number tag #60100237 (maybe the 237th one ever built?), purchased new in June 1994.

The Rig

The TS-60S is a rugged-looking piece of gear. With few front-panel controls, it appears deceivingly simple, but this is a very sophisticated radio that holds its own with the best equipment ever used on 6 meters. Despite its miniscule (7" x 2-3/8" x 9-5/32", WxHxD) dimensions and tiny exterior heat sink, it is also a powerful radio, rated at 90 watts output power (SSB, CW, FM; 20W on AM). Most of the transmitter's power amplifier heat sink is inside the radio, and is fan-cooled with a thermostatic control that maintains a safe PA temperature at maximum output power. For FM users, the TS-60S features 100 memories—more than anyone could ever need—and standard "PL" CTCSS tones. Programming repeater channels uses the two VFOs and any frequency split is accommodated, from zero offset (simplex) to 4 MHz input/output spacing.

Operation

When you first power up the TS-60S, its display greets you with a friendly "HELLO." The ON/OFF switch has about a one-second delay, preventing accidental punches of the "OFF" button from turning the radio off. The receiver is sensitive, selective and reasonably immune to overload (see Note 1). Because of its diminutive size, input/output jacks are all either RCA "phono" type (ALC and RELAY) or 3.5mm "mini" phone type (PHONES, KEY, EXT SPEAKER), although the microphone jack is the standard-sized Kenwood eight-pin, which will accommodate a variety of Kenwood microphones. The normally-supplied hand-held PTT mike is the MC47, which features both "UP/DOWN" buttons and four programmable priority functions. The supplied microphone sounds excellent on the air and received rave reviews on both SSB and FM from the stations contacted.

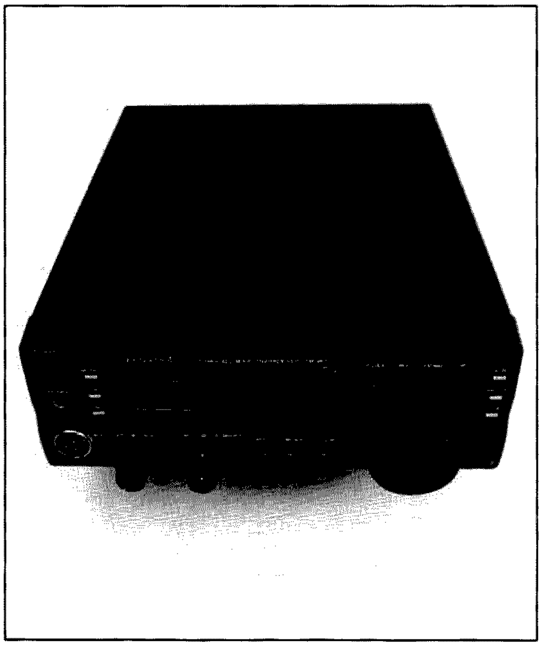


Photo A. The Kenwood TS-60S all-mode transceiver.

Three things initially bothered me about the TS-60S: One, the "fuzzy logic" VFO tuning speed control system, which makes the rig tune faster as you turn the VFO knob faster; two, the lack of a panel-mounted transmitter power output level control; and three, the lack of a panel-mounted mike gain control. I'm not used to radios having variable-rate tuning, and it does take some getting used to. When the dial-drag lever on the TS-60S (located immediately below the VFO main tuning knob) is switched to the "minimum drag" position, it is possible to "spin" the dial across the band. Doing so makes the VFO change frequency very rapidly, much faster than you would think after turning the knob slowly. However, I'll admit it only took me a few minutes to become accustomed to the variable-rate tuning system and, after this initiation period, I liked it.

Although I like continuously-variable power output controls on my rigs, it isn't much of a selling point for 6 meter equipment. Most 6 meter users will run the radio "wide open" at full output 99% of the time anyway, as there's no special place in heaven for 6 meter QRPers. (The rig does have three power output levels, controlled by the operating menu, which is easy to get used to.) The "continuous" output control is more useful on HF, and this is a VHF radio. The only time I might want more output level control is when operating at a Field Day station, where there's a special multiplier for stations running 5 watts output power—the TS-60S can only "QRP" down to 10 watts. Oh, well. The Japanese engineers who designed this radio probably aren't aware of U.S. Field Day rules.

The lack of a panel-mounted mike

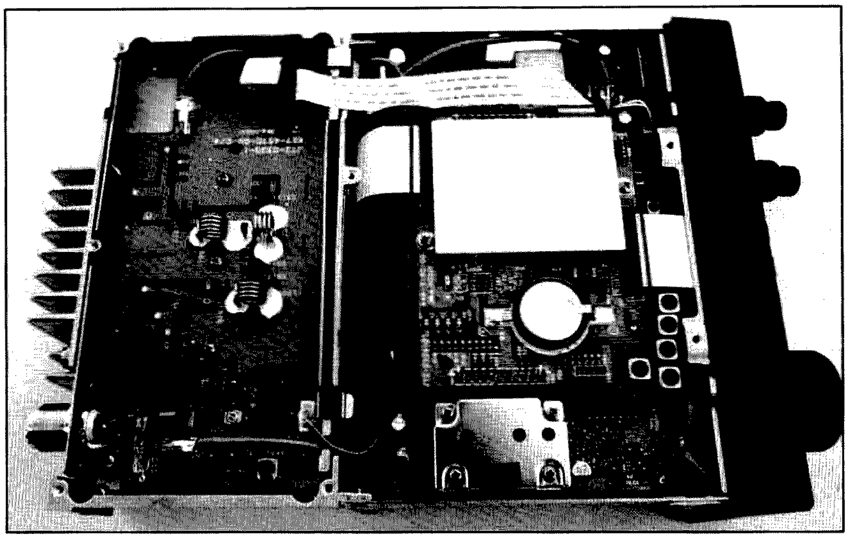


Photo B. The underbelly of the TS-60S. Note the fan's edge in the center, and the output low-pass filter and antenna T/R relay on the output board. The shiny round thing is a 3V battery used for memory backup.

gain control still bothers me a bit. There is a mike gain control, as well as an FM deviation level control, located inside the TS-60S, but you have to remove the top or bottom cover (depending on which one you want to adjust) to make any changes. Considering the variations in operators' voices, this wasn't a great idea; however, one of the 40 menu-addressable functions is "microphone gain High or Low," selected as #66 on "Menu B." Making adjustments using the menus sounds far more difficult than it is. It's so easy, in fact, that once I read the simple description of how to do it, I never had to refer back to the 59-page instruction manual again. That is, except to refer to the "Menu Number" and "Description" of each function, which would be almost impossible to memorize.

Since the TS-60S front panel contains only 24 knobs, controls and switches (a small number compared to most base-station radios nowadays!), only those which must be frequently adjusted are placed there. Obviously, the on/off (POWER) switch, volume (AF) control, squelch (SQL), tuning dial and mode switches (SSB/CW on one button and FM/AM on another) will be most often used. In addition, the TS-60S has panel-mounted receiver incremental tuning (RIT) and IF SHIFT controls, plus switches for its noise blanker (NB), advanced intercept point system and receiver attenuator (AIP/ATT), changing between the two VFOs (A/B), splitting the VFOs (SPLIT), setting the two VFOs to the same frequency (A=B), locking the frequency (F.LOCK), stepping the frequency in MHz increments (MHz), buttons to control both frequency and scanning direction, and menu items (DOWN and UP) activate the scanner (SCAN), entering data to memory (M.IN), entering memory data to the VFO (M>V), switching between memory and VFO modes (M/V), and clearing an operation such as a menu address (CLR). Some of these switches will be infrequently used, except in initial setup, but need to be on the panel to avoid confusion from having to address multiple menu items simultaneously.

The panel switches with more than one label "toggle" between two functions. An example is the AIP/ATT switch which, when first depressed, activates the AIP feature (to prevent receiver overload in strong-signal environments). When depressed again, the same switch activates the attenuator. When depressed a third time, it activates both AIP and ATT. When depressed a fourth time, it turns AIP and ATT off, clearing the system and returning back to normal full-sensitivity receiver operation. Maybe Japan has a lot of 6 meter operators in a small area; I cannot envision ever needing the AIP or ATT here, since the strongest signals I could find did not overload this receiver, anyway.

Menu Functions

Depressing the MENU button clears the frequency display and addresses either MENU A or MENU B, selectable with the front-panel A/B switch (also used to switch between the VFOs). You then spin the main tuning knob to the menu item you want, which is indicated on the left-hand side of the main display panel, then use the UP and DOWN buttons to toggle the features of that menu item. As stated earlier, this sounds more complicated than it is.

For example: Say you want to switch from full power (the default setting) to the QRP 10-watt output level. Press the MENU button, then the A/B button, until the letter "A" appears in the main display, then spin the tuning knob until menu number "00" appears on the left-hand side under the word "MENU." Menu item "00" is the power setting. Push the DOWN button twice, and you'll see the display go from 100 to 50 to 10, indicating you're now set at 10 watts output power. Then push either the MENU button again, or the CLR button, and the radio reverts to normal operation, but now at the 10W power level. This all takes about two seconds—not difficult at all. If you want to program a "PL" tone for repeater operation, you'd depress MENU, then "B," then turn the tuning control to bring up menu item #53, then depress either UP or DOWN to arrive at the right tone frequency (the PL tone frequencies are displayed directly in Hz), then either MENU or CLR, and you're done. I wouldn't do this "on the fly," while driving down the freeway at 55 mph, but it's easy to do while parked, or on the bench at home. Besides these two MENU functions there are 38 others, some of which are almost silly.

Silly menu functions: Five levels of adjustable display brightness (!); CW keying delay adjustable from full QSK (no delay) to 1.8 seconds delay (a real long time) in 10 increments; RIT range (two increments); automatic power off function (turns radio off after a period of non-use); three separate menu items to adjust the beep tones the rig emits when functioning controls; etc. Who cares? But the TS-60S has all these, and many more useful functions as well.

One neat thing about the rig and its MC47 microphone is the ability to program the mike's four "priority" buttons to perform any of 26 functions, all menu-addressable. You could, for example, program the rig so that one of the priority keys controls the rig's output power, and another one controls its mike gain (from High to Low, anyway), thus almost overcoming my initial objections to these items not being on the front panel.

The Manual

The TS-60S instruction manual is typically-Kenwood excellent, with clear, concise explanations of all controls and functions. However, it completely lacks any circuit description and leaves the owner wondering what the heck's inside the rig. There is a two-page "Troubleshooting" guide, but it only points out what should be obvious operator errors and gives no clues about what to do if something in the radio actually fails. I'd really like to see detailed circuit descriptions (e.g., "The received signal passes though a nine-section bandpass filter and is fed to the first RF amplifier, a 40673 MOSFET, before reaching the first RF mixer, a doubly-balanced set of 5082-2800 hot-carrier diodes having an LO injection level of +13 dBm at 70 MHz," or whatever). In the old days, most equipment manuals contained such descriptions, and they helped explain how the rig really worked and helped the user read through the schematic diagram and make sense of the circuitry.

Circuitry

The rig comes complete with schematic diagrams, a set of four-page fan-folded dual-sided sheets that appear complete enough for me to offer this abbreviated description:

The antenna feeds a low-pass filter always in series with the receiver, as well as a 40-60 MHz bandpass filter, and is relay-switched to either a pair of 2SK520 JFETs in parallel (presumably for a high intercept point) as an

RF preamp, or directly to the balanced JFET RF mixer (four 2SK520s), depending on whether the "AIP" circuit is in use or not. (The "AIP" circuit, when switched "ON," bypasses the RF preamplifier, using switching diodes.) The "ATT" (attenuator), if activated, is relay-switched. There is an intricate array of front-end protective components called a "lightning surge arrestor" circuit, which appears to be metal-oxide varistors in series with small-signal switching diodes to reduce the capacitance of the MOVs. This is a common approach and might help protect the JFETs against lightning transients. The local oscillator injection to the first RF mixer is provided by the PLL UNIT's output which tunes 113.045-133.045 MHz and produces a first IF at 73.045 MHz (this is called "upconverting"; that is, the first IF is at a higher frequency than the received signal input). The tuning range of the PLL is so broad because the TS-60S does feature a 40-60 MHz continuous-coverage receiver, although it can only transmit in the 50-53.999 MHz range.

Table 1.
TS-60S Measurements Taken

Transmitter output power into a 50-ohm load, 13.8 VDC supply:

SSB (peak)/CW/FM	HI 95W	MED 44W	LO 10W
AM	HI 20W	MED 15W	LO 5W

Receiver sensitivity, closed 50-ohm system:

SSB/CW	MDS	<-130	dBm	(<.07 µV)
	10 dB S+N/N	-117.5	dBm	(0.3 µV)
	"S1"	-107	dBm	(1.0 µV)
	"S3"	-104	dBm	(1.4 µV)
	"S5"	-98.5	dBm	(2.6 µV)
	"S7"	-89.5	dBm	(7.5 µV)
	"S9"	-77.5	dBm	(30 µV)
	"+20 dB"	-57	dBm	(300 µV)
	"+40 dB"	-37	dBm	(3.2 mV)
	"+60 dB"	-20	dBm	(23 mV)
	IF BW	2.19	kHz	@ -6 dB
FM	Sqlch threshold	-125	dBm	(.13 µV)
	20 dB NQ	-112	dBm	(0.6 µV)
	"DFQ"	-92	dBm	(6 µV)
	"S1"	-113	dBm	(.5 µV)
	"S3"	-110	dBm	(.7 µV)
	"S5"	-108	dBm	(.9 µV)
	"S7"	-105	dBm	(1.2 µV)
	"S9"	-102	dBm	(1.8 µV)
	"+20 dB"	-97	dBm	(3.1 µV)
	"+40 dB"	-94	dBm	(4.5 µV)
	"+60 dB"	-92	dBm	(6 µV)
	IF BW	5.05	kHz	@ - 6 dB

Blocking dynamic range: Approx 105 dB

The first IF is filtered by XF1, a crystal filter at 73.045 MHz, before the signal passes to the second mixer, another pair of 2SK520 JFETs; between the crystal filter and the second mixer is the first IF amplifier, a 3SK131 dual-gate MOSFET, which is AGC-controlled by bias applied to its second gate. This same stage also drives the receiver's NOISE BLANKER circuit, a common pulse-clipper type. The second mixer injection is at 62.35 MHz and also provided by the PLL UNIT, to produce a second IF at 10.695 MHz. This is the last conversion stage used for SSB/AM/CW. The second IF signal passes through either a 5 kHz bandpass filter for AM, or a 2.2 kHz bandpass filter for SSB/CW (or an optional, sharper CW filter), before being amplified by a 2SC2712 bipolar IF amplifier, whose output drives a hybrid integrated circuit product detector system using additional postamplification provided by a pair of 3SK131 MOSFETs and a balanced detector using a pair of HSM88AS diodes. The carrier injection to the product detector is a signal at 10.695 MHz provided by the PLL UNIT.

On FM, the receiver employs an additional conversion stage producing an IF of 455 kHz, standard in the FM industry. This last conversion stage uses an MC3372 integrated FM IF subsystem having its own local oscillator and a 12 kHz monolithic bandpass filter. Thus, on SSB/CW/AM the TS-60S is dual-conversion, while on FM it is triple-conversion. This makes a good deal of sense, considering the FM IF subsystem integration available today, which helps make FM receivers as simple as they are.

The transmitted SSB/CW/AM signal is generated by an integrated circuit balanced modulator, type uPC1037HA, which is audio-driven by the microphone preamplifiers, shaping circuits and a 2SC2712 bipolar buffer amplifier, and has carrier injection at 10.695 MHz provided by the PLL UNIT, the same source as used for product detection in the receiver. The output of the balanced modulator is diode-switched to the same set of bandpass (crystal) filters used In the receiver's second IF, then buffered by another 3SK131 MOSFET which has ALC control by bias to its second gate, before passing to the first transmitter mixer, a pair of 3SK131s having an L.O. injection at 62.35 MHz provided by the PLL UNIT. The mixer's output is bandpass filtered and mixed again by another balanced mixer using a pair of 3SK184 dual-gate MOSFETs having an injection at 123.045-127.045 MHz, again provided by the PLL UNIT. The second transmitter mixer's output at 50-54 MHz is bandpass filtered, buffered by a 2SC2954 bipolar transistor and then fed to the FINAL UNIT for additional amplification.

The FINAL UNIT consists of a "predriver," type 2SC1971, a "drive amp," a pair of push-pull 2SC1972s, and then the "final amp," a pair of push-pull MRF492s or 2SC2879s. (Depending on where you look in the schematics, both part types are called out.) The final's output signal passes through a 54 MHz low-pass filter before reaching the SWR protection circuit and antenna relay. The FINAL UNIT also contains a sophisticated temperature control system which drives the internal heat sink cooling fan. In fact, the comparator circuit which supplies signals to the fan motor drive transistors (three type DTD114EK bipolars) has three separate outputs to drive the fan at progressively higher speeds as the heat sink reaches higher temperatures! Speaking of fans, the one in the TS-60S kicks into operation after only 15 to 20 seconds keydown time at full power. If you transmit longer, the fan speeds up. When operating at full power for any length of time, the fan reaches maximum velocity and creates an audible noise level that might be distracting if the operator doesn't use headphones.

Obviously, this circuit description is an abbreviated overview and doesn't go into much detail, but it offers the technical readers some feel for the rig's circuitry. I enjoy perusing schematic diagrams, taking tips from the "pros" on circuit design. I was gratified that the TS-60S uses discrete, rather than integrated, final output transistors (cheap, easy to replace), and a push-pull output circuit which should practically eliminate any second-harmonic output, leaving only the third harmonic to filter (a much easier task, since it's so far away from the desired frequency).

Features and Options

The TS-60S comes with a 6-1/2-foot-long DC power cable fused in both leads, using automotive-style cartridge fuses which are inexpensive and readily available (hooray!). It also comes with a mounting bracket, although a better one, model MB-13 (list price $47.95), is available. Other options include a matching heavy-duty AC power supply, model PS53 ($249.95); a high-stabillty temperature-compensated crystal oscillator reference for the frequency synthesizer, model SO-2 ($179.95); a narrow CW filter, YK-107C ($109.95); a variety of desk-stand microphones (MC60A dynamic $149.95; MC80 electret $104.95; MC85 multiple-output electret with compression control and meter $159.95), and other lesser-used items. I wouldn't buy an accessory speaker for the rig, as its internal top-mounted speaker is loud and sounds great. Unfortunately, the optional CW filter and TCXO are both solder-in, not plug-in, accessories. Oh, well.

The TS-60S "S" meter and power output level meter are of the "bar graph" variety and are quite useful. The bar graph power output level display reads "0 to 10," and provides only relative output power indications. For example, on the unit tested, a display reading of "1" corresponded to 5 watts output; "2" was 10W; about "2.5" was 15W; about "4.5" was 20W; a bit over "7" was 42W; and "10" was full power, which in this case was 95W or so. I was able to achieve all these different output levels by using the menu-driven power output level control and by switching modes between CW and AM (AM always runs less power than CW/FM, regardless of the control setting).

The bar graph S-meter is quite good on SSB/CW and pretty useless on FM, as is the case with most multimode transceivers I've seen. While the receiver's MDS (minimum discernible signal) on SSB/CW was less than -130 dBm (under 0.1 µV), the S-meter doesn't indicate anything until about -107 dBm (1 µV) signal is applied to the antenna jack. Above this signal strength, the meter is surprisingly good. An "S9" signal was 30 µV; "+20 dB/S9" was 300 µV (exactly a 20 dB

change); "+40 dB" was 3.2 mV (again, a 20 dB change); and "+60 dB" was 23 mV (a 17 dB change). As S-meters go, this one is pretty accurate. On FM, all bets are off. "S1" required -113 dBm (0.5 µV), but "S9" was only -102 dBm (1.8 µV), a change of only 11 dB for an indicated 8 "S" points difference (which should be 48 dB or so). On FM, the meter indicating "+20 dB" only required -97 dBm (5 dB more than "S9"), and "+40 dB" required -94 dBm (only 3 dB more than "+20"). S-meter accuracy can be useful (even on FM) for beam steering.

The receiver in the TS-60S is top-notch. Not only did I make bench measurements using a lab-standard signal generator, but I compared the rig with my much more expensive Yaesu FT-736R and its 6 meter module. Results? The little TS-60S held its own very well against the full-sized, base-station FT-736R. There was almost no measurable difference in sensitivity between the two, and extremely weak signals tuned in on both sounded about the same. (I used the XE2UZL beacon in Mexico, which operates around the clock on 50.027 MHz, as a QSB-free standard. When I turn my beam to null this beacon, it becomes a very steady, unwavering weak signal, just above the noise. It's a great reference signal!) The IF filtering in the TS-60S is certainly adequate (rated 2.2 kHz/-6 dB for the SSB filter; measured at 2.189 kHz/-6 dB), but more amazing is the receiver's ability to resist desensitization from strong off-channel signals.

The Author's Experience

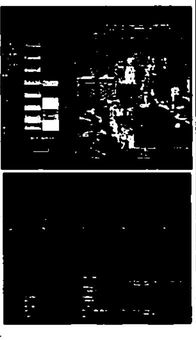
I ran this test: I nulled the XE2UZL beacon until it was almost in the noise, registering "S0" on the meter, and barely detectable. Then I introduced a signal offset by 10 kHz, at 50.037 MHz, from my signal generator, essentially in parallel with the antenna connection. I had to adjust the generator's level to -24 dBm, or about 12 millivolts, before I could detect any change in level on the weak beacon. This is a difference in signal strength of more than 105 dB, and the 12 millivolt signal is far stronger than any I've ever come across on the air, including from stations operating only a few miles away. Older-generation 6 meter receivers were never this good.)

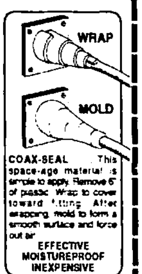
The receiver is also almost free of internally-generated spurious signals. The "other side" of the IF filter "shadow" signals are greatly attenuated, and any very strong signals occurring outside the IF passband can likely be rejected further with the IF SHIFT tuning control, which works well.

OK, already: How does it play on the air? Like a champ! As I mentioned, I borrowed the radio for this review. After playing with it for one day, I really didn't want to give it back. But I had to—this was written right in the middle of the peak sporadic-E season (June) and the rig's owner, KD6EQW, was chomping at the bit to get back on the air. Chuck uses a Diamond DP-GH62 collinear vertical base station antenna (vertically polarized, 21' tall, 6 dB rated gain) at about 25' above ground with the TS-60S and has already had a ball with it, working E-skip all over the country with this nominal antenna. He intends to also use it mobile, with either a Larson 5/8-wave 2 meter whip (surprise—these work just fine as a 1/4-wave on six) or an M-Squared "Sqloop" horizontal, omnidirectional antenna on his truck, and should have some great fun doing so.

Two caveats are worth mentioning: First, if you are measuring your vehicle for determining where and how to mount the TS-60S before actually buying one, be aware that Kenwood's published dimensions need clarification. Its "depth" specification is 233mm, which corresponds to about 9-5/32"; however, the rig is really 10-5/8" deep, if measured from the main tuning knob to the rear heat-sink fins. Only the case measures 233mm, but you'll need more space than this for the rig. Second, on the remote chance you'll be using the rig for AM work (as opposed to SSB), be advised this is not a great-sounding AM rig. Like most SSB radios using "low-level" modulation for full-carrier AM, power output for AM work must be substantially reduced from the SSB peak value, and even then, modulation is anything but "broadcast quality." The TS-60S, like many SSB rigs used on AM, produces "downwards modulation," meaning its output power actually drops down on modulation voice peaks. This is remedied to some degree by using the rig in the "medium" or "low" power settings, where it runs 15W or 5W output, rather than the full 20W produced in the "high" setting. Frankly, there's not much AM activity on 6, and if that's all you want a rig to do, a less expensive choice would be an old Gonset G50, Clegg Thor-VI, or some similar—if ancient—high-level modulated AM rig.

Six meters is a great band. It offers a combination of VHF tropospheric and HF ionospheric propagation and might be the only amateur band capable of producing strong-signal contacts from local, direct-wave to 10,000-mile F2-layer DX contacts, with lots of useful propagation in between. WAS, WAC, DXCC are all possible on 6 meters, and maybe WAZ will be someday, too, with increased activity and the return of a solar cycle peak. Best sporadic-E "skip" conditions occur at the beginning of the summer and winter seasons, but the band is known for producing lots of "E-skip" all through the months of June and July (in the northern hemisphere). There's bound to be local FM simplex and repeater activity, too, in most parts of the country. The TS-60S combines a good receiver with a powerful enough transmitter to work most anything right out of the box, and it provides an amplifier keying circuit to interface with an outboard high-powered amp for serious QRO (high powered) work. There are a variety of power amplifiers now on the market, both solid-state and tube type, as well as some excellent 6 meter antennas, to compliment the TS-60S as a serious base station for 50 MHz enthusiasts. ■





Number 6 on your Feedback card

440-450 MHz Omnidirectional Antenna

Build this UHF base or repeater antenna for less than 10 bucks!

by Marty Gammel KAØNAN

Recently I was asked to rebuild a UHF repeater antenna that was given to a friend of mine. The design was not one that I was familiar with, but I did rebuild the repeater antenna with the same design that was in the PVC shell. The previous owner had forgotten to use the 95% velocity factor when figuring out his lengths. It matched in free space, but was 21 MHz off when installed in the PVC antenna housing. I had to make all new parts to bring the antenna down into the 70cm ham band. That repeater is on the air and working just fine now.

After rebuilding that antenna, I decided to try my hand at building a cleanly designed antenna with enough gain for base station or repeater use, about 5 dB. The new antenna had to be weatherproof, compact, easy to mount, and easy to build with common tools. The design I settled on was one that I had built for 2 meters years ago. A 20-year-old *ARRL Handbook* was the source of the design I wanted to rework: three half waves in phase, using a half-wave 52-ohm phasing section of coax. I wanted to encase this in PVC pipe to maintain a stable environment.

"Once you have gathered together all the needed materials, you should have a completed, tuned antenna in a couple of hours."

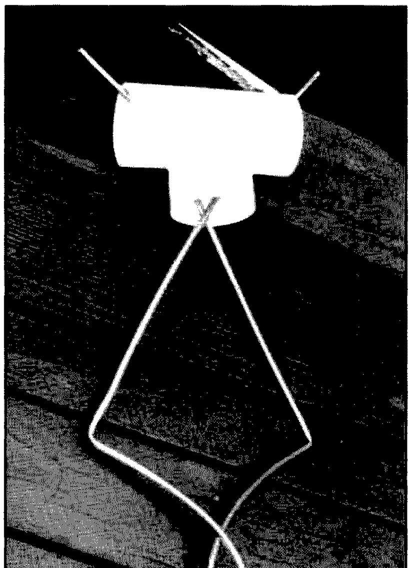


Photo A. Squeeze the copper tubing ends together and insert them through the center opening of the "T" fitting.

Parts

To make this antenna you will need some 1-1/2" i.d. schedule 40 PVC pipe, two "tee" fittings, two end caps, some low-loss RG-8 or RG-213 coax, and some 3/16" copper tubing. You may also want to use some styrofoam (see text below).

I found it would be necessary to enclose the antenna in PVC, based upon my experience with my 2 meter version of this antenna years ago. The copper had turned almost black from chimney gases and exposure to the weather. Also, the lower section of the copper had split from moisture refreezing during a cold, wet winter.

Once you have gathered together all the needed materials, you should have a completed, tuned antenna in a couple of hours.

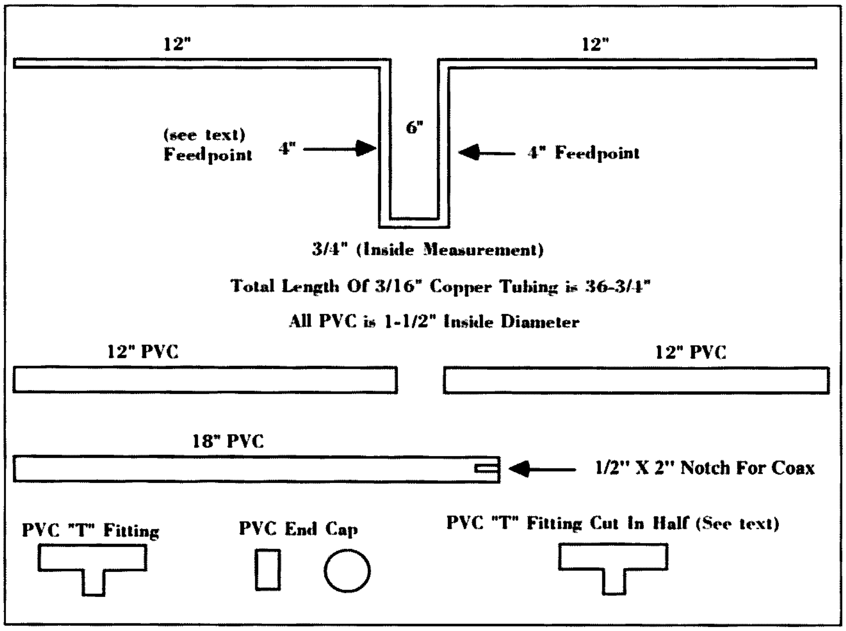


Figure 1. 440-450 MHz PVC base or repeater antenna.

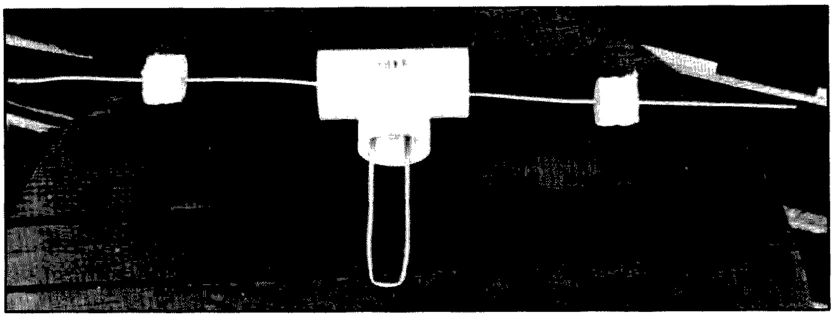


Photo B. Once the tubing is inside the "T" fitting, straighten it out to make it look like an antenna.

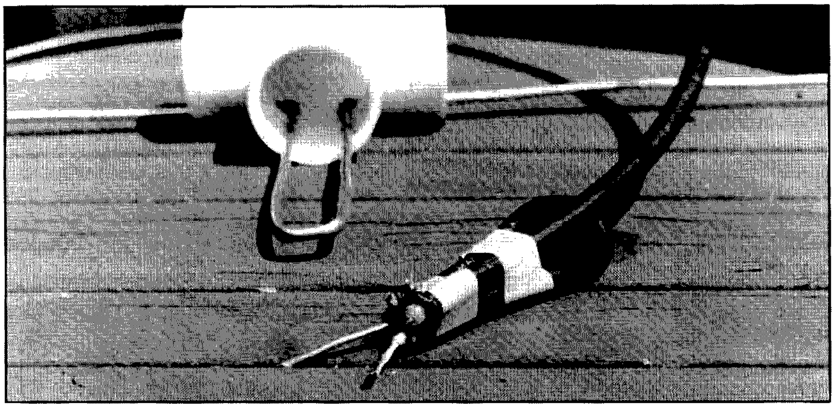


Photo C. Use coax to make the phasing section.

Making the Antenna

First, I cut all the needed pieces of the 1-1/2" PVC pipe to length with a hacksaw. Cut two pieces 12" long for the vertical sections, and one piece about 18" long for the horizontal section that houses the tuning stub.

After cutting the PVC pipe, smooth out the rough edges with sandpaper to help make the assembly process easier.

Now comes the important part! Decide on the portion of the 420 to 450 MHz band on which you want to operate. I chose 438-450 MHz for the repeater and simplex area of the band. When you enclose an antenna in PVC pipe, you must figure in the velocity factor of PVC pipe, 95%, into the formula. This meant that I needed 36-3/4" of copper tubing. This was determined by using the formula for a half wave found in any *ARRL Handbook*: 468 divided by the frequency in MHz = the length. Then you must allow for the PVC pipe by using the 95% velocity factor. $468/F_{MHz} \times 0.95$ = final length.

Figure 1 shows the proper lengths and configuration to bend the 3/16" copper tubing to make it radiate properly. Use a vise if you have access to one to get nice square, accurate bends. The first section is 12" long, then a 90-degree bend, then a 6" length, then another 90-degree bend. Allow 3/4" spacing on the tuning stub at the center of the antenna. You are now halfway done with the bending process. Bend the other half of the tubing to match the first half of the antenna.

Squeeze the tubing ends together and insert them through the center opening of the "T" fitting (see Photo A). Once the tubing is inside the "T" fitting, you can straighten the tubing out to make it look like an antenna again, as in Photo B. The copper tubing does not have to be perfectly straight.

Now make a phasing section of 52-ohm coax, again using the correct velocity factor for your coax. Using RG-8 foam coax, with a velocity factor of 80%, meant that I needed a piece 10" long. Other types of RG-8 or RG-213 have different velocity factors; some use 66% or 78%, so check your *ARRL Handbook* to determine which one is correct for your coax.

Attach the phasing section to the coax by connecting the shields from both ends of the phasing section to the shield of the feedline stub (see Figure 2). Tape the phasing stub to the feedline stub with electrical tape. Be sure that the phasing stub with coax attached will fit inside the 18" section of PVC pipe. Attach the center conductors to each side of the tuning stub at about 4" from the vertical sections of the antenna. This is the feed point (see Figure 2 and Photos C and D). Bend the ends around the tubing snugly to make the soldering job easier.

Again try inserting the coax with the tuning stub connected to ensure that it will still fit inside the 18" piece of PVC pipe. In one end of the 18" piece of PVC you need to cut a notch wide enough for the coax, and deep enough to clear the "T" fitting about 2" (see Photo D). After the assembly and tuning of the antenna, you will want to caulk the notch in the PVC to give a weatherproof seal.

The Assembly Process

Assemble the complete antenna dry to make sure everything fits properly (see Photo E). During this assembly process, you may want to cut some scrap styrofoam pieces to keep the copper tubing in the center of the PVC pipe (see photos). I used a hole saw, but you can cut the pieces of styrofoam with a knife if necessary. Attach the antenna to a mast with the stainless-steel band clamps. You may want to tape the joints of the PVC together while you do the tuning of the antenna. *Do not glue any of the pieces together until the tuning process is complete.*

Tuning the Antenna

Use an SWR bridge capable of accurate measurements at 440-450 MHz to check the top, middle, and bottom of your desired frequency spread. The feed point should be about 4" from the vertical sections of the copper tubing. Moving the feed point an eighth of an inch will change the match quite a bit. Once you have found the best feed point, solder the coax center conductors to it securely, and tape the phasing section to the tuning stub tightly. Slide this assembly into the 18" section of PVC and check the match again. If it is still good, you can glue the 18" section of PVC to the "T" fitting. Glue the 12" sections of PVC to the "T" fitting, but *do not* glue the end caps yet.

As a final tuning trick, put a small flat-

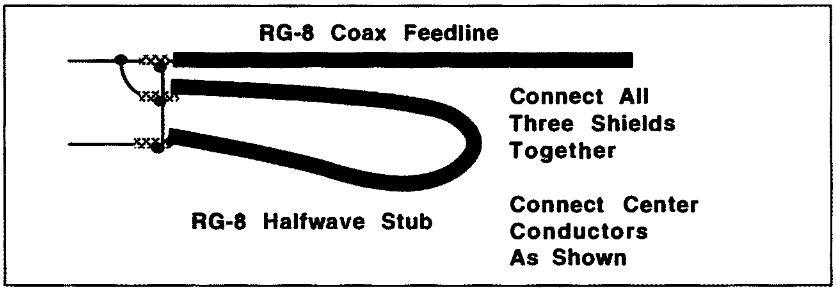


Figure 2. Half-wave phasing section detail.

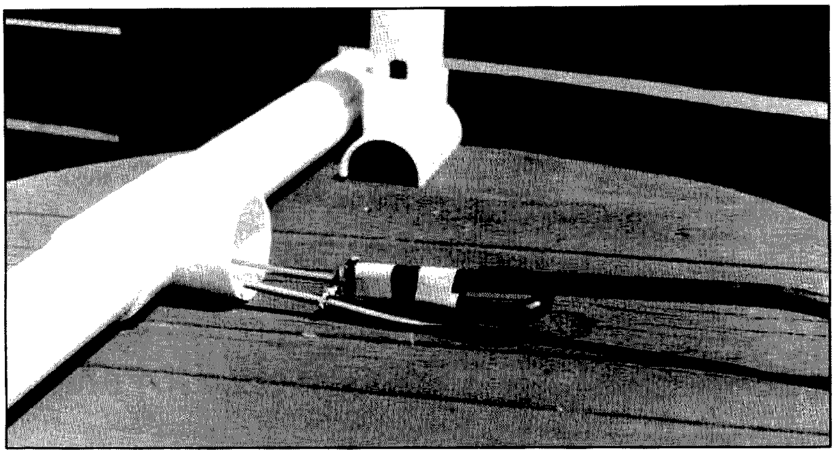


Photo D. Attach the phasing section to the tuning stub (foreground). Notice the notch in the PVC for the coax (background).

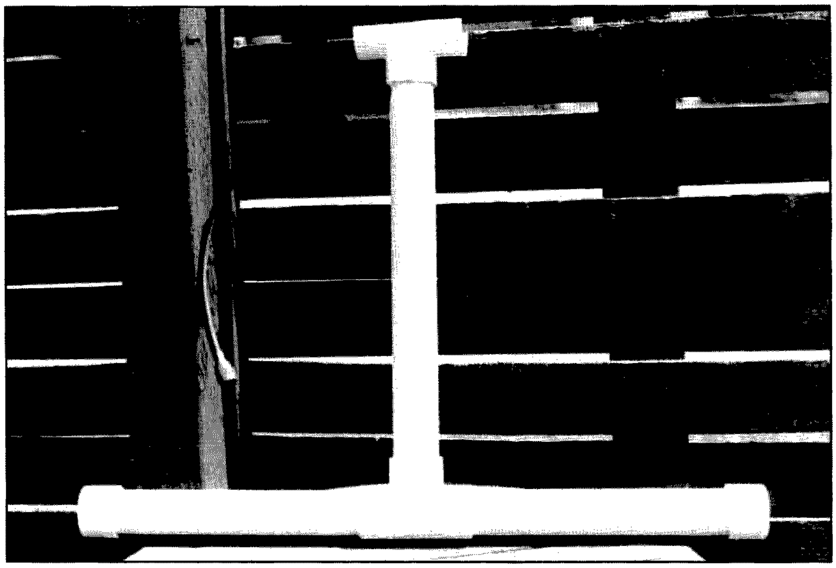


Photo E. The completed 440-450 MHz antenna, ready for mounting.

or pan-head #4 stainless-steel self-tapping screw into each end of the vertical copper tubing to fine-tune the length. Start out with the screws all the way in, and adjust by unscrewing in small increments until you are happy with the match. On my first attempt, I glued the caps on, and had to settle for 1.35 to 1 for the best match. By using the screws to fine-tune you can get 1.1 to 1 or 1.2 to 1 for your final match. On my second try I wound up with a 1.16 to 1 match at 450 MHz, and 1.35 to 1 at 438 MHz.

Final Assembly

When final tuning is complete, glue the end caps on, and glue on the split "T" fitting. Apply some silicone or butyl rubber caulking to the area where the coax goes through the PVC to weather-seal the opening. I used some duct tape on the opening area of the split "T" that seats against the mast to further seal out any bugs or moisture, and to give a cushioning mount to the mast. Attach the completed antenna to your mast or tower leg with the stainless steel band clamps, connect your coax or hardline to your stub, and weather-seal this junction.

"Pay close attention to the formulas used in this project. They make the difference between success and failure."

Builder's Notes

If you can get a match ranging from 1.2 to 1.6 over about 10 MHz, you have achieved success. All joints must be sealed to keep out any moisture. Pay close attention to the formulas used in this project. They make the difference between success and failure. Refer back to the text and the drawings and photos before doing any gluing; PVC glue is fast-setting and permanent (10 seconds). You may want to use a piece of self-sticking rubber non-skid tub tread instead of duct tape to seal the open end of the split "T" fitting. Use the lowest-loss coax or hardline as your main feedline to cut down on losses; feedline losses are quite large at 450 MHz.

Parts List

My sources locally were Builders Square and Hardware Hank Stores for all items needed to make this antenna.

2 pieces	12" long 1-1/2" PVC pipe
1 piece	About 18" long 1-1/2" PVC pipe
2	1-1/2" Tee fittings *Schedule 40 Pressure type PVC*
36-3/4"	Of 3/16" copper tubing, refrigeration type
2	2-1/2" stainless steel band clamps (for mounting)

Styrofoam (to keep copper tubing centered inside PVC)
Duct tape (to seal the open end of the split PVC "T" fitting)

Tools List

PVC cement
Hacksaw
Tape measure
Electrical tape
Vise (optional)
Hole saw (optional)

Materials Cost List

10' length of 1-1/2" PVC pipe	$3.00
36-3/4" length of 3/16" copper tubing	$1.25
2 1-1/2" PVC "T" fittings	$2.00
2 1-1/2" PVC end caps	$1.25
2 2-1/2" stainless band clamps	$1.00
Total materials cost	$8.50

A Review of Formulas Used with the Copper Tubing

At the frequency of use, a 1/4 wave = 6.3" x 6 = 37.8" of 3/16" tubing. The velocity factor of PVC pipe is 95%; 37.8 x 95% = 35.91". I round this off to 36" and add the 0.75" center of the tuning stub to come up with the 36.75" overall length of the tubing.

Formulas Used with the 52-Ohm Phasing Stub

12.6" = a half wave x 0.80 = 10.08" for RG-8 foam; x 0.66 = 8.316" for RG-8A solid dielectric and RG-213; x 0.78 = 9.828" for 9914 Belden foam.

If you have questions about this antenna please write to me, including a #10 SASE: Marty Gammel KAØNAN, 1703 Hewitt Ave., St. Paul MN 55104-1128. I hope that you get many years of service out of this antenna, and I would like to thank John Berglund KØUBA for his help in editing. 73s and happy hamming to all of you who like making your own antennas, instead of just buying whatever the manufacturers decide that we want!

73 Review

Number 7 on your Feedback card

by Gordon West WB6NOA

Alinco Electronics Inc.
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Torrance CA 90501
Telephone: (310) 618-8616;
Fax (310) 618-8758
Price Class: $269

The Alinco DJ-G1T Handheld

An HT with a built-in spectrum analyzer!

Alinco advertises that their new DJ-G1T 2 meter handheld possesses a unique feature that no other handheld on the market has—*a built-in spectrum analyzer.* Most amazing—what kind of circuitry in a dual-conversion, super-heterodyne receiver could let you look at the VHF band in the frequency domain?

The Alinco DJ-G1T is part of a series of four band-scope transceivers that are offered in Japan—DJ-G10, -G40 (for 440), -Z10, and -Z40; the last two without the touch-tone pad. Alinco USA brings in just the VHF version with the touch-tone pad for now, but indicates that the UHF version with band scope may be just around the corner.

Power

The new Alinco DJ-G1 has the build of a stocky HT—it's not real thin, nor is it real tall. It fits nicely in your hand and is sized at 50mm wide, 116mm high, and 37mm deep. It comes with a 7.2 volt, 700 mAh battery pack that slides up inside the unit like you would load a pistol. Seven volts at 700 mils is a nice balance of 2 watts power output on high, drawing about 980 mA on high power transmit. The pack can give you a quarter-watt output on low power at 375 mils, and on medium power your output is 1 watt at around 750 mils. Power output is easily selected by a "function PO" command on the front panel.

If you absolutely need high power output at 5 watts plus, you can go for the optional EBP-32N 12-volt pack that will consume over 1,500 mA on high power output. If long life is what you need with your handheld, I would recommend the optional Alinco 7.2-volt pack at 1,200 mA, and this should last you the better part of a day. However, this pack and the high-power pack will add additional inches to the bottom of the transceiver. And all emergency communicators should carry the EDH-14 alkaline battery tray, and this tray fits flush with the bottom of the unit for 9 volts at about 4 watts out, and a dramatic improvement over nickel cadmium on how long your batteries will last.

I go into detail about the importance of the right size battery pack because no handheld with any type of fancy display or capabilities is any good with a dead set of batteries. So when you buy any handheld, take a close look at battery voltage, current consumption on transmit, and the milliamp hour capacity of the battery pack that comes with the unit or is sold as an option.

Operation

The Alinco DJ-G1 is a 2 meter transceiver with added 440 MHz receive capabilities. In some parts of the country there are repeater systems that could allow for some crossband options-transmitting on 2 meters, and then cycling back to receive on the 440 band. The 440 receive capabilities will probably perk the interest of scanner enthusiasts that will ask the inevitable question, "Can the set be modified for out-of-band public safety receive?" The answer is, "Yes, by going into the insides of the unit, cutting the red and blue wire loops, and unleashing receive capabilities from 400 MHz all the way up through 511 MHz."

Photo A. The Alinco DJ-G1T.

On the VHF side of the transceiver you get wideband receive capabilities from 108 MHz through 174 MHz. But if you plan to hear any aeronautical calls down around 110 MHz to 130 MHz, you need to specifically call up the AM side of the receiver.

1. Push the VFO button to get into the VFO mode.
2. Push the hold function, push "low PTT," and the letter "A" will appear in the screen indicating AM reception.
3. Now write into memory all of your aeronautical receive channels.
4. Cancel out by repeating the above steps to return to FM mode.

Features

Incredibly, the DJ-G1T comes with 80 memory channels out of the box, and you don't need to buy any memory expansion chip for these 80. Most other handhelds come with about 40 channels; and while this is OK, it's generally not enough for scanner enthusiasts up on 460 MHz.

Now, before I go into the spectrum analyzer "band scope" feature that sets this unit apart from all others, let's explore a few more "features" that are relatively common on most high-quality, single-band and dual-band 2 meter transceivers. Here's what the DJ-G1 offers:

- Auto dialer with 5 memories
- Auto dialer delay programming options
- DSQ for private paging common to other brands of handhelds
- CTCSS encoder built in, with simple plug-in provisions for optional encode/decode board
- Six scan modes
- Odd splits on all 80 memory channels
- CAP/MARS TX capabilities
- Priority watch
- Reverse function
- Momentary or constant backlight
- Backlit keypad (looks great at night)
- Auto power off
- Battery level indicator
- Battery save function
- Programmable scan time
- Programmable scan edge frequencies
- Call channel

I think you get the idea here—nothing was left out when it came to bells and whistles, of which most ham operators will only use a fraction of the unique capabilities of their single-band or dual-band handheld. I tried out many of these features and can report that they all work. No surprise here—although I was pleased to see that the pager function in the DSQ mode is similar to what you might find in Icom, Kenwood, and Yaesu radios, too. This means that your radio will be compatible with a DSQ system, if an enterprising ham has inaugurated one through a local club or repeater organization.

Spectrum Analyzer

This is not the first time I have seen a quasi spectrum analyzer built into an amateur radio communications receiver. I have a little-known Standard radio AX700 receiver that can be switched into a spectrum analyzer with undulating vertical bars going up and down in time with incoming signal strengths on center frequency and a few hundred kilohertz to each side. This is the same idea that Alinco has incorporated into their oversized and very legible LCD display window.

To enter the channel scope mode, get into VFO, hold function, and then push the "8" key for "Search." The conventional left-to-right LCD bar graph for signal strength instantly disappears, and now vertical bars illustrate frequency occupancy on seven ever-changing pedestals. The default value is 5 kHz per pedestal, and this is really too tight to be of much interest in what's really happening on the next channel up or down.

It's easy to change this—get out of the spectrum analyzer mode, get into the frequency step mode, and select either 15 kHz or 20 kHz 2 meter channel separation for your particular part of the country. *Now* this feature gets useful: You can see two channels down and two channels up, for near-channel activity. And if you want even a larger look, go into 50 kHz steps, and now you can see 150 kHz up and 150 kHz down from center frequency.

Out here in Southern California, 146.52, 146.55, and 146.58 are all common simplex frequencies. But repeater pairs are sometimes spaced only 15 kHz apart, so I set my band scope for 15 kHz steps. While operating on 146.550 MHz simplex, I could clearly see the activity taking place below me on 146.520 MHz, and could also see that I still had an open channel to QSY to up on 146.580 MHz without having to go up and take a listen.

While rotating through the frequencies in the band-scope mode, you can watch the signals whiz by on the screen as you tune by them. But it takes the receiver section of this transceiver about a second to finally bring up the audio because of the scanning technique used in the band scope. You could also detect the rather slow five-second scan rate by noticing the audio dropout on the frequency you were listening to, and also watching the slow change in signal strength on those frequencies indicated above and below center frequency. In other words, if you are listening to 146.520, you will see the signal strength of the other station instantly vary because you are on center frequency. But if someone should stop transmitting down 30 kHz, someone who you have been watching to the left of center, it may take three or four seconds before that LCD signal strength indicator drops to zero.

You can also run the channel scope to monitor nine memory channels: four below you, four above you, and the memory channel you are actively listening to. If you are tuned into nine different repeaters, you will see all of their activity on the scope. When any repeater drops out, you will see their LCD signal strength drop. But this drop could be delayed by as much as three seconds due to the scanning technique employed in this channel scope scheme. And just like before, every five seconds, the frequency you are listening to abruptly drops out as the microprocessor quickly whizzes through the channels to refresh the channel scope readout.

In the channel scope mode, your active listening is interrupted every few seconds as if you had a priority watch switched on. This is a bit annoying, but it's the only way that the set can refresh its look at frequencies around you. But if you are looking for activity on up to nine normally quiet repeater frequencies, you can quickly spot it and see which way to turn the dial to get to that activity by watching the scan scope. This is a feature that I liked very much.

Does the scan scope really mean all that much to the average hand-held radio user? Probably not—but it does look a little bit impressive when you check it out for the first time. After you play with it for a few days, you will see that it is best used for seeing what's happening on four channels down, and four channels up from the present frequency you are tuned into.

It's nice to see a big LCD display. The audio output was also good, measured at around 250 milliwatts. This is adequate when you're holding the unit in your hand, but not nearly adequate if you're trying to pick up a call with the unit worn on your belt and a jacket over it. An external speaker microphone that Alinco offers is a great way to get the most out of the audio output.

I tried my usual torture tests of dropping the unit from a coffee table to a hardwood floor, and the worst I could do was to slightly scratch the convex clear plastic screen. Transmit audio sounded full and clear, and factory deviation was set to 4.5 kHz, just about right for today's crowded bands. VHF sensitivity was relatively hot at about 0.08 microvolts, and the UHF side of the equipment was hot at around .15 µV They are not running a complete separate receiver for UHF, so it's common to find a UHF receive-only capability somewhat close from the TX/RX capability for the band that the unit was designed for. And for public safety monitoring at 460 MHz, you have plenty of sensitivity to spare at .15 µV.

The instruction book is not necessarily glamorous, but it gives you plenty of detail on how to run this unit through its paces. I made several phone calls to Alinco for follow-up information, and all of the gang up there including Taka on the technical bench were more than helpful, spending some phone time with me answering any question that I could come up with. Alinco is not so big that the technicians are isolated from the public—and it's fun to talk with the techs because some of these folks were actually in on the original design work of the equipment in Japan.

So the new Alinco handheld does its job well, with the "spectrum analyzer band scope" both a gee-whiz and something that could be used on the service bench. But if you're out there in the boondocks looking for activity, you'll see it long before you'll hear it in the 50 kHz step mode. That in itself is one great feature on this very unique portable transceiver from Alinco.

73 Review

Number 8 on your Feedback card

by Jeff M. Gold AC4HF

MXM Industries
Rt. 1 Box 156C
Smithville TX 78957
Telephone: (512) 237-3906
Price: $129.95

The MXM Simple Transceiver

An easy-to-build single-band CW QRP kit.

There are a number of reasons to build a radio from a kit. I get a great deal of satisfaction from talking to hams on a piece of equipment I have assembled myself. The building process itself is often worth the price of the kit (I often say building is cheaper than therapy). And, if you have a problem with a rig, you are much more likely to be able to repair it yourself if it's something you've built yourself.

One of the first kits I ever assembled was MXM Industries' 40 meter transmitter/receiver combination, an inexpensive kit that I picked up at a hamfest. I did not know much about soldering, much less about building a working radio. I made a number of mistakes during assembly and managed to blow up a few transistors in the transmitter, but in the end I had a working radio. I enjoyed building the kit and was very excited when I was able to actually talk to someone on it. The receiver was a VFO-controlled superhet that worked well. The transmitter produced a nice signal, but was crystal-controlled. You also had to manually switch between transmit and receive. Being stuck on one transmit frequency and having to manually switch from transmit to receive made this a seldom-used rig.

What's Included

MXM's new kit provided my wished-for improvements. These transceiver kits are made for a single band to work on CW, and are available for 80, 40, 30 or 20 meters. The receiver is a double-conversion single-signal design and employs dual filtering. The rig features electronic QSK keying and a variable pitch control that can be used for bandwidth control. It puts out approximately 3 watts. The kit comes with a nice printed circuit board, all board parts, air-variable capacitors for main tuning and pitch control, and a very nice aluminum case (I liked the case the way it came and didn't bother to paint it). The kit does not include the potentiometer for volume control (available from Radio Shack for about $1.30, or at most hamfests). It also doesn't come with the jacks to connect the headphones, power and key; many people like to choose their own types of connectors and keep them in their ham shacks.

Putting It Together

The first page of the instructions says "CAUTION: The MXM Simple Transceiver is a very sophisticated design. It is recommended ONLY for experienced builders." This is probably the only line I disagree with in the entire documentation—I found this a very easy kit to build. However, new builders might need help with the alignment process.

The entire transceiver goes together on a single printed circuit board. The board is very clearly silk-screened and there is an excellent parts overlay. There is also a nice parts list that helps avoid confusion and identify parts. These features make it very easy to locate the correct part and place it in the proper place on the board. I found the single-sided board easy to solder on. It is also fairly easy to remove a part from this board if you should put it in the wrong place or need to replace it.

The directions are not step-by-step, but they are very clear and easy to follow. The first part of the instructions explains in understandable terms the design of each section of the transceiver. If you should have a problem during the final testing, this part of the instructions becomes a valuable tool. The parts overlay shows the underside traces of the board as well as the labeled parts. This is another great aid in finding possible problems. The schematic is very clear and easy to read.

I often find myself doing really dumb things. I will take great care in building a kit. I will carefully align it. But, if it's late I may put the kit away for a while and then do something like hook up the power backwards or put the board on the table on top of small pieces of scrap wire or solder. These things can lead to major smoke. Whether you use them or not, diagnostic aides such as good schematics, circuit descriptions and overlays showing the bottom side of the printed circuit board are worth their weight in gold.

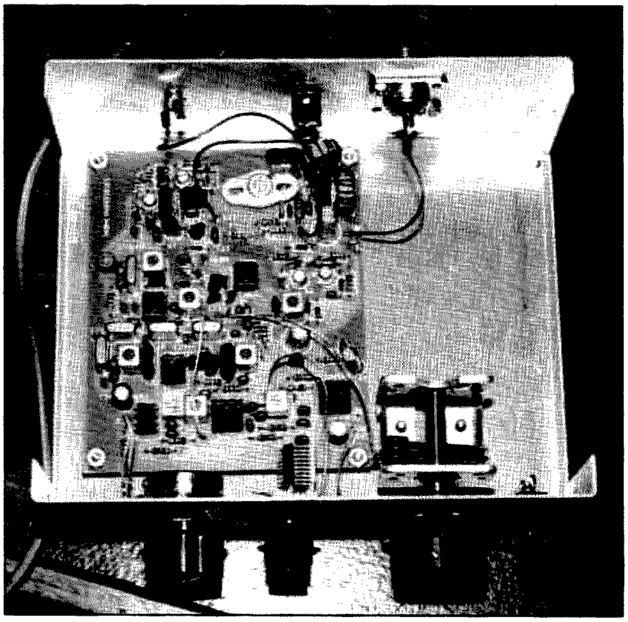

Photo A. The MXM Simple Transceiver.

I really liked the way the construction steps were handled. You build the transceiver in sections and check and align each section before proceeding. This gives you intermediate sources of gratification as well as making it easier to identify problems as you build up the kit.

The instructions are separated into construction and alignment sections. After you build a section of the radio, you go to the appropriate part of the alignment section. The first section you build is the IF. In order to align this section you need a source for a 4 MHz signal.

The directions say you can use the fifth 4 MHz crystal included in the kit for the transmitter to build an oscillator. The instructions refer you to the *ARRL Handbook* if you need circuit details for the oscillator.

I have an MFJ antenna analyzer, which works by injecting a low-level signal into the antenna and then using it to measure reflected power. I find that this piece of test equipment works well as a signal source. You might also find it helpful to have a frequency counter. The alignment instructions provide for checking the frequency at two test points. You can, however, do the alignment without the frequency counter. To tune the IF section you tune a transformer until you hear an audio level which will indicate that the oscillator is operating. You can hook the frequency counter or scope to a test point and measure the frequency, which should be 455 kHz. Next, you tune another transformer to get strong audio output and check the frequency at a different test point. The frequency should be at 4.455 MHz. This adjustment is very precise and may take you a couple of tries to get it right. You are tuning the IF section to detect the 4 MHz signal coming through the crystal filter. The last adjustments are to two more transformers for maximum audio output. These are fairly broad adjustments and should present no problem.

The next section you build is the RF section. You will need a source to generate a signal for the band the kit is on. You can use a separate transmitter/transceiver or other signal source. I once again used my antenna analyzer to provide a signal source. You tune a transformer until you can hear a signal that is in the band the kit was built for, then repeak the other transformers.

The last section you build is the transmitter. You need only tune one transformer in this section to purify the signal and route it to the rest of the transmitter. You can use an oscilloscope and/or wattmeter. If you only have a wattmeter you can tune for the most power output. With a scope you will monitor the waveform of the transmitted signal and get it as clean as possible. You will also need to set a variable capacitor to make sure that you are transmitting and receiving on the same frequency. I always find it easier to use my main station transceiver for this. I transmit with the power level off and no antenna hooked to my main transceiver. I then locate this signal on the receiver I am aligning. Next I transmit with the kit and tune the variable capacitor to bring it right on frequency. I usually repeat this a few times on different frequencies to ensure I have it set correctly. This also allows you to listen to the quality and sound of the kit's transmitted signal.

Once you have done the initial checkout and alignment you are ready to mount the board and controls in the case. It is suggested that you mount the board in the case, making the wider part of the case the front. You then mount the board in the left section and the air variable capacitor for tuning to the left of the case. This will leave plenty of room if you want to modify the rig later by adding an electronic keyer or additional filtering.

Once you have everything in the case, you fine-tune the various stages. To accomplish this you hook the transceiver to a resonant antenna. You again use a nearby 4 MHz signal source and repeak the transformers. The directions are very clear. You will need to follow them step-by-step to get the proper performance out of the receiver and transmitter.

I found my kit went together very easily. I was very pleased with the clarity of the instructions and the quality of the parts. I didn't find myself confused about how to assemble any part of the kit. Sometimes I like building something just for pure relaxation, and this kit really did the trick.

Performance

Once the kit was together and aligned, I was anxious to get it on the air. I hooked the rig up to my main station antenna (a quad). The receiver is sensitive; if the signal is there, you should hear it. One of the features that sets this transceiver apart from other QRP kits is the CW pitch control. The pitch control uses an air variable to control the CW pitch of the incoming signal. The control allows variation of the output frequency of the product-detector oscillator. You can set the pitch to a tone that you prefer. More importantly, this provides variable bandwidth control by moving the injected signal nearer or farther from the edges of the filter's bandwidth. When the band gets noisy or crowded it becomes a useful filter.

My transmitter put out a little over 2 watts. I had no trouble at this power level making contacts. I prefer electronic keying. I find relay-controlled transmit/receive switching can become annoying in some cases. The QSK in this transceiver proved to be effective.

After completing the final alignment procedures I anxiously tuned across the band. Luckily the band was in fair condition. Almost immediately I heard AA1HJ calling CQ. I answered his call. Dave in Newton, New Hampshire, and I had a nice QSO for a short while. He reported I was a 559 but a tad off his frequency. Well, no one is perfect. I went back and redid the variable capacitor tuning. I next contacted Bob N2NQG in Toms River, New Jersey. He was a 599 and reported I was a 569. He was using 100 watts to my 2 watts. I felt I was doing a good job.

The bottom line is that this is one of the least expensive superhet-based kits on the market. It is fun, easy and enjoyable to assemble. Beginners may need some assistance with the alignment, but should be able to meet with success. Once on the air I think you will be happy with the fruits of your labor.

73 Review

Number 9 on your Feedback card

by *Jeff M. Gold AC4HF*

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State MS 39762
Telephone: (800) 647-1800; FAX (601) 323-6551;
Technical help (800) 647-8324.
Price Class: $249.95

The MFJ-1786 Super Hi-Q Loop

A compact multiband HF antenna.

I was anxious to try out the new MFJ loop when I first saw their advertisement. I have both read and heard many heated discussions about small loop antennas. A small multiband antenna that can be set up in minutes or used in places where space is at a premium or antenna restrictions are in effect would be a good investment, if it performed as advertised.

The antenna arrived one afternoon while I was at work. My wife called me to ask what type of monstrosity I had purchased this time, because there was a huge heavy box that had just arrived.

The antenna has a diameter of 36 inches. This means it can fit fully assembled in the back of a small car. It is constructed of thick-walled aluminum pipe. The current carrying joints are welded to increase the efficiency of the antenna. One of the major drawbacks of a small loop is that it can be very lossy. The manual states that the antenna was designed with the intention of keeping the losses down by paying particular attention to the electrical and mechanical construction of the antenna. MFJ claims that by using this design method, the loop should radiate nearly as well as a half-wave dipole (they use the term "full-size dipole" in the manual). To accomplish this goal they use large-diameter thick-walled aluminum pipe for the radiating element, set into shape by a special machine. The joints are heliarc welded to eliminate resistive pressure connections. For tuning they used a specially constructed (arc-welded) butterfly capacitor which has a lower loss resistance. The antenna is heavy. The materials are good quality, and so is the construction.

Location and Mounting

The manual goes on to explain the radiating patterns, polarization of the antenna, and suggested locations for mounting. You can either vertically or horizontally mount the antenna. If you mount the loop standing up you will get vertical polarization. When mounted vertically, the antenna is directional. The nulls occur perpendicular to the loop's axis.

Mounting the antenna horizontally will result in an omnidirectional horizontally-polarized pattern. The pattern will have a null straight up and straight below the center of the antenna. This will cause the ground reflection to cancel the signal unless the loop is mounted high enough away from the ground or structures that act as ground planes. A small loop is generally quieter on receiving when horizontally polarized. Horizontally polarized loops are not good for ground-wave communications, but work well for medium to long-distance skywave communications.

Where you are able to mount the antenna will also determine how you mount it. If you mount the loop less than 20 feet above a metal roof or other ground plane it probably will not work very well at all. I believe incorrect placement and mounting account for much of the bad reputation the small loop has received.

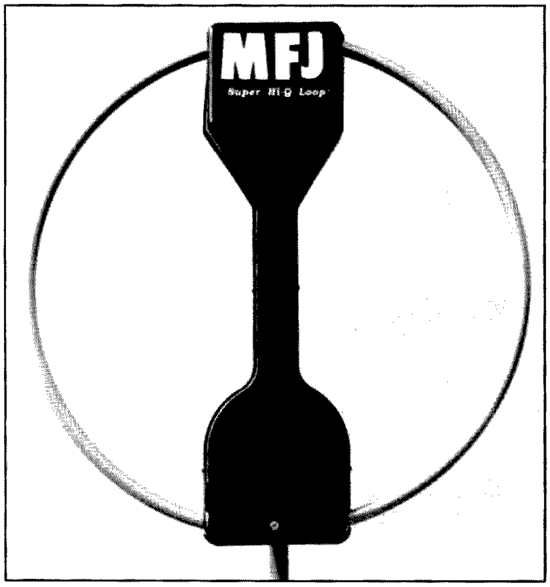

Photo 1. The MFJ Super Hi-Q Loop.

The loop will operate from 10-30 meters and should tune to 1:1. Tuning is done by an indoor remote control unit. This is a semi-automatic tuner. It has a built-in cross-needle wattmeter with both high and low power ranges. The tuning and control voltages are fed through the coax. This means you don't need to hook up any additional wiring. The remote control can be powered by an optional AC adapter or you can put batteries into the unit for portable use. There is a lamp on/off button to help save energy when using the unit with battery power. Above the SWR/power meter are three buttons: the power button, the hi/lo power range control, and the lamp button. On the right top section on the front panel are a series of four buttons and four LEDs. The right-most section is the Auto Band Select. This is for fast tuning. To its left are the fine-tuning controls.

You can tune the loop in several ways. If you don't know which band the current setting is on you can either go to the topmost setting (10 meters) or bottom setting (30 meters). To go to the top of the tuning range you push the UP button. When the loop is at the top of the tuning range the FREQ UP LED will light and it will automatically stop. This will take up to 45 seconds, depending on what the last setting was. You then key your transmitter with a steady 1-50 watts on the frequency you want to tune, then push the AUTO BAND SELECT "DOWN" button. The loop will tune 'til it is just past the frequency. A beeper will go off and the remote will stop tuning. You then press the "Down" button to turn it off. As you release the FAST TUNE (Band Select) button, one of the FINE TUNE LEDs will be on. It will tell you if you need to fine-tune up or down. You just press the appropriate button and observe the cross needles until you get to 1:1. If you go a little too far, you just press the opposite fine-tune button. This procedure is a lot easier in practice than It is trying to describe it in words. After you have done It once it is a simple procedure. The manual describes the process clearly and completely.

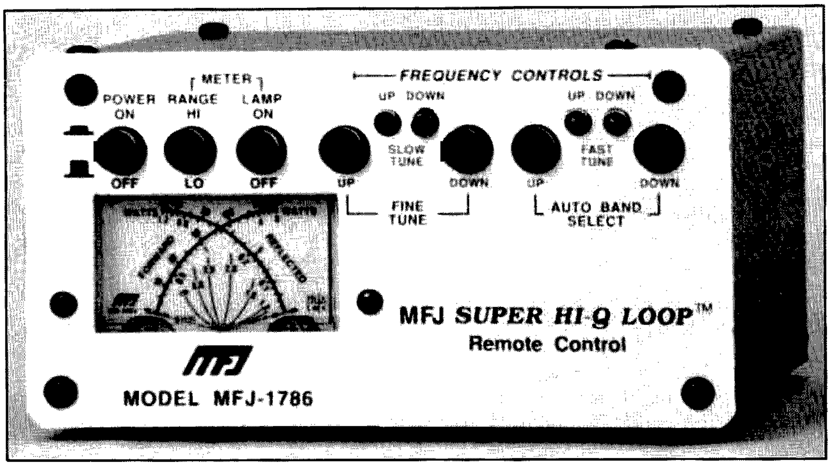

Photo 2. The MFJ-1786 Remote Control.

I first tested the loop in a horizontal configuration. I kept the installation as simple as possible. I had a spare piece of thick-walled PVC pipe about five or so feet long that I mounted to the antenna. I put the loop over my shoulder and climbed the tower to the roof of the house. I put the loop up at about 22 feet and used the crossbeam of the tower to help stabilize the antenna. I was able to completely mount the antenna on the roof, including feeding the coax out of the house through the shack floor, in less than 20 minutes. I don't recommend this method for permanent installations. The antenna is fairly heavy for its size and the PVC pipe would not be sufficient to hold the antenna over a long period of time. If I were going to leave the antenna up, I would have mounted it higher and replaced the PVC with some real pipe.

I went into the house to test out the new antenna. I opened the manual and went through the initial test procedures. I didn't encounter any problems so I decided it was time for an on-the-air test. I first tried 30 meter CW. I came across W1ZEI/4 calling CQ. I had a nice chat with Brownie in Florida. He was a 539 and I was a 569. I told him I was testing out a new antenna and he reported I was "doing FB." Propagation must have been towards Florida because I next worked Lew in Winter Park, Florida. He was a 579 and I was a 589. He stated "loop doing very good into central Florida." I worked many other contacts.

I had recently finished testing out the new MFJ SSB 20 meter low powered travel radio and decided it would be a good test of the antenna to see how it did with low power on SSB. I tuned the loop to 20 meters. It took about a minute to change bands and fine-tune. I heard a DX station calling with a fair number of North American stations trying to call him. CT1DYX, Pedro in Portugal, was 58 coming into North Central Tennessee and reported I was a 52-55. While on 20 meters I next worked Paul in St. John's, Newfoundland. Again there was a number of stations calling him. He was using the special call VO1IMD to commemorate Marconi's birthday from the site where Marconi first received a transcontinental signal. Paul's home call is VO1HE. We talked for a while and he reported my signal and audio were good. His signal was a 58 and mine was a 56-58. After chatting a while he realized he was supposed to be making as many contacts as possible so I let him go. I also worked Tony KF2QI, in Sayville, New York, with the Travel Radio. His signal was a 59 and reported mine was a 57. We had a nice chat and discussed the operating conditions on both ends. He couldn't believe I was on low power. He said "I am using 300 watts. You have a fantastic signal—says a lot for QRP."

Testing

Our University club brought the antenna along on a recent QRP expedition. We hoisted the antenna up about 30 feet into a tree. We guyed the sides to two other trees. The antenna worked reasonably well in this configuration.

I have very carefully tried to conduct the traditional antenna comparison. I have eight transceivers and four antennas hooked up in a way that I can easily flip a switch or two for comparison of either rigs or antennas. I was very pleased and impressed with the performance of this antenna. The effectiveness of the loop as with all antennas has to do with many variables such as what is near it, what type of ground you have in your area, is there water nearby, how high is the antenna, how high is your QTH, and what the band conditions like. I think data on the theoretical gain of an antenna is important, but there are sufficient variables involved to force you to look at how the antenna will perform for you under your specific conditions. I did in fact do many comparisons. My quad was significantly better, but that would be expected. I tested the loop against my Gap vertical. Depending on the day, band conditions, band and distance from the sending station, the antenna performances varied. The vertical would out perform the loop one time and then the loop would win another. Sometimes the two antennas would perform equally.

Results

Once again I think this antenna was designed for a couple of specific types of application (limited space or portability). Ed Hare KA1CV, ARRL Laboratory Supervisor, stated in May 1994 *QST* (p. 35, sidebar), " . . . I'd done some antenna modeling of small loops using EINEC. I'd learned that a small loop at low heights above ground slightly out performs a half-wave dipole at low angles of radiation (those best for DX)."

For a loop to perform well, it *must* be set up properly. MFJ clearly tells you how to do this in the Instruction manual. I found the manual to be very well written. It was complete and easy to understand. The manual includes theory of operation, set up considerations, step-by-step testing procedures and operating procedures.

Another aspect of this antenna is that it is a "HI-Q" antenna. This means there is less noise on receive with this antenna, but the bandwidth for a good SWR is narrow. The tuning takes a little getting used to, but is not difficult. If you move a little bit on frequency you will need to retune the antenna. If you are going to sit on a frequency and call CQ this isn't a problem. If you are going to tune the band or switch bands a lot, you should take this into consideration. My overall impression of this antenna is that *it performed surprisingly well* for its size, especially when you consider that I was operating mainly QRP with the antenna only 22 feet high and hanging slightly off my tower.

HAM HELP

Number 10 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS (Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit, (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I would like to get information and the addresses of manufacturers of amateur radio equipment. I am in the process of setting up a small retail business in the Oklahoma City area to help the amateur community. I am looking for reputable companies that give good service on their equipment. *Glen Collins, 812 Hunter Hill, Oklahoma City OK 73127.*

I need information on a good 2 meter base rig. I do not want a Handi-talki or mobile; I need something that will handle CW, SSB and FM. I also need information as to where I can get a small 20-10 meter beam, as I have limited yard space. Please send replies to *Rev. John J. Kubenski, Sr., 1102 12th Ave. SE, Jamestown ND 58401.*

Does anyone know of any amateur radio software for the Coco III computer? It would not matter if it was just for BASIC, DISK BASIC or OS9 Level I or II. I would like to use my Coco III for WeFax, RTTY, CW and whatever else in radio communications. If you have any leads or information, please help. *David Guess, 121 U.S. 31W Bypass Apt. 6, Bowling Green KY 42101.*

I need to build an inexpensive, grapefruit-sized, mains-operated power supply, 12V (AC or DC) at 60 amps. All help/info/advice gratefully acknowledged. *Alex Funke KC6IWR, 1176 Fiske St., Pacific Palisades CA 90272.*

If anyone has information on modifications that can be made to the "HAL" DS3000 KSR terminal to enhance its operations, especially a mod that could provide an ASCII output as messages are displayed on the screen, please contact *Eric A. Slokes Sr. WA8ZJY, 11415 West Pkwy., Detroit MI 48239.*

NEEDED: Service manual for a HEATHKIT Multi-Speed Servo Chart Recorder Model IR-18M Series 02240. I also need chart paper #445-19 for the same machine. I will pay for copies and postage. Thanks. *John Ellenburg, 6009 Fall Creek Rd., Russellville TN 37860.*

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73 Review

Number 12 on your Feedback card

by Dave Pelaez AH2AR/5

Bilal Company
137 Manchester Dr.
Florissant CO 80816
Telephone: (719) 687-0650
Price Class: $59.95

The Isotron 40

The neighbors might think it's a futuristic bird feeder, but it's really a compact, horizontally-polarized 40 meter antenna!

Let's face it . . . a 40 meter antenna that is small enough to fit inside a trash bag probably puts out about as much signal as a dummy load, right? Also, if it looks unconventional, it must not work as well as a normal antenna, right? Surprise! Both of these premises are incorrect! The Isotron antenna is an excellent example of one that shouldn't work because it simply doesn't "look" right . . . at least this is what I thought before actually buying one of these antennas. But work it does! Much to my surprise, the Isotron 40 meter antenna has performed so well it has now become a part of my permanent HF installation. As long as the antenna is electrically correct, and laws of physics aren't broken, many unusual antenna designs are possible. And this antenna has proven to be no exception. Let's take a closer look at this extremely compact HF antenna that could be the answer for hams with antenna space limitations.

In business since 1980, Ralph Bilal WDØEJA has actually designed six different Isotrons for 160, 80, 40, 20, 15 and 10 meters. A search for the "textbook" name for these antennas came up "empty." I discovered that Mr. Bilal coined the term "Isotron" to describe his design which is really quite unique.

Construction

I found the instructions provided were excellent. Assembly time is about 40 minutes, start to finish. The only tools that are required are a screwdriver, pliers, and a small wrench. You must purchase a five-foot mast section in order to fully assemble the antenna, as the mast section is not included. There is no need to break out the soldering gun or wire stripper. The SO-239 connector is pigtailed at the factory and the coil assembly is pre-wound, stripped, and tinned. The total part count is 10, and all fastening hardware is stainless steel.

Installation

Wayne would indeed grimace. I decided to mount the antenna for testing in the attic, knowing full well of the E-Fields that would be present (another good reason not to run the amp!). This installation was to keep myself in good graces with the XYL. As we had just moved into a newly-constructed home, I had earlier ruled out putting up a dipole, as the closest "attachment point" for a wire antenna was a transplanted sapling that I had earlier mistaken for a large Texas weed. So up went the Isotron.

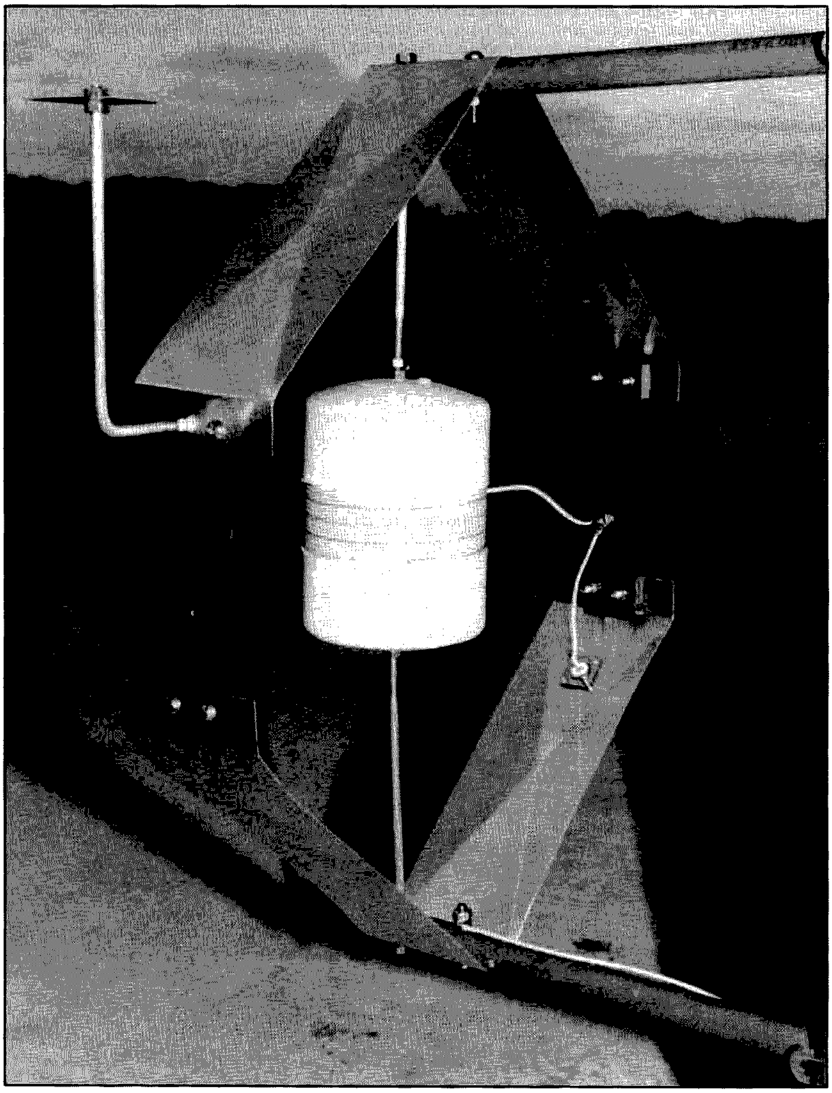

Photo A. The Isotron 40.

Tuning

The most challenging part of the assembly is the tuning of the antenna to find its resonant point. Mr. Bilai has compiled a detailed step-by-step process to make this "black art" less tedious. In fact, the instructions are complete enough so you do not have to rely on a noise bridge to adjust the antenna's resonant point. Tuning this antenna is a matter of pivoting a capacitance hat that is attached to an aluminum rod from the vertical, and past the horizontal, rotating the rod to the "front" of the antenna. The instruction booklet contains some neat tricks and shortcuts on how to arrive at the desired resonant point. These helpful hints are a product of a whole lot of "corporate memory" that greatly assists the new Isotron purchaser in avoiding the potential pitfalls of bringing the antenna to resonance. For in-band utilization, no trimming of the coil is required; however, the instruction manual explains the procedure for trimming the coil if the antenna is going to be used for out-of-band activities (MARS CAP FAA etc).

Once the resonant point is found, you will notice a dramatically steep resonance skirt. In my installation, I have a minimum centered 1.1 to 1 VSWR and a usable 3 to 1 VSWR about 150 kHz up and down the band. More typically, a 250 kHz tuning range can be expected. This "usable" tuning range will vary, depending on the installation environment. An Isotron in the clear, as opposed to one located next to metal attic ductwork, will behave differently. Past the usable range, the VSWR ends up going off the chart very quickly.

Operation

My first perception after tuning the antenna was that I had the transmission line hooked up to an in-the-clear dipole. I listened up and down the band, and the usable bandwidth was very active with many signals. The atmospheric noise level seemed to be a bit quieter than "normal." Frankly, I was expecting to hear only a few of the "big guns" on the band, but I was pleasantly surprised to hear an active band. After one final check of the VSWR, I broke into about a half dozen QSOs. I was also surprised that I could work 'em. This was not expected, especially with my compromise attic installation. I tried another "test" later in the week with some friends who were about 40 miles out (ground wave). It was interesting to note that the station on the other end was experiencing a high noise level due to a distant thunderstorm. He was using a long-wire antenna, and we both were running about 100 watts.

> ***"I've been amazed that we have been able to consistently communicate from Dallas using an attic antenna about the size of a small Texas watermelon."***

Up to three different Isotrons can be connected in parallel; however, the manufacturer recommends the utilization of a noise bridge, as mutual coupling causes the overall impedance to become an average of the three antennas, making the tuning process extremely complicated.

How Does It Work?

I have successfully kept an active 40 meter schedule with KK4LW/7 who lives in Fort Collins, Colorado. I've been amazed that we have been able to consistently communicate from Dallas using an attic antenna about the size of a small Texas watermelon. Just remember one thing: The "feed point" does not require the placement of bird seed between the coil and the plates.

Adapting Bell 202 Telephone Modems for Packet

Enjoy packet radio with this bargain basement project!

by Robert B. Whitaker KI5PG

If you are the type of person who loves to adapt and modify equipment for amateur radio use, this project is for you. Even if you already have a TNC but you want to experiment with packet modems and software, it will interest you. If you have not yet joined the packet revolution and are looking for an inexpensive way to test the waters, this project may be just your ticket.

Like many other projects, this one started out first as an experiment. I ran across a number of old Bell 202 standard modems that a lady had purchased for a bargain price at an auction of surplus computer gear. She did not know how to use them and asked me if I might be interested in them. They were so cheap I bought them, gambling that they could be modified for use on packet radio. With a little effort and the assistance of my good friend and knowledgeable ham, Harvey Babb WB5MCT, we together made the Bell 202 modems sing happily on 1200 bps VHF amateur packet radio.

Basically, all that is needed to make a Bell 202 modem work on amateur packet radio is a keying circuit and operating software. There are already a number of modem programs for the PC compatibles. Perhaps the most widely used and available program is Baycom, by Florian Radlherr DL8MBT and Johannes Kneip DG3RBU, from Germany (see Note 1). Another very popular packet modem program, Poor Man's Packet, debuted as the cover story and feature article in the August 1991 issue of *73* magazine (see Note 2). PMP was the joint project of Andy Payne N8KEI, who wrote the software, and F. Kevin Feeney WB2EMS, who designed the PMP modem. Both of these fine gentlemen are to be commended for their work. Although the PMP modem and software were designed for use on the PC parallel port, the software can be easily configured to address the PC RS-232 serial port. Table 1 shows the changes required to the PMP.CFG

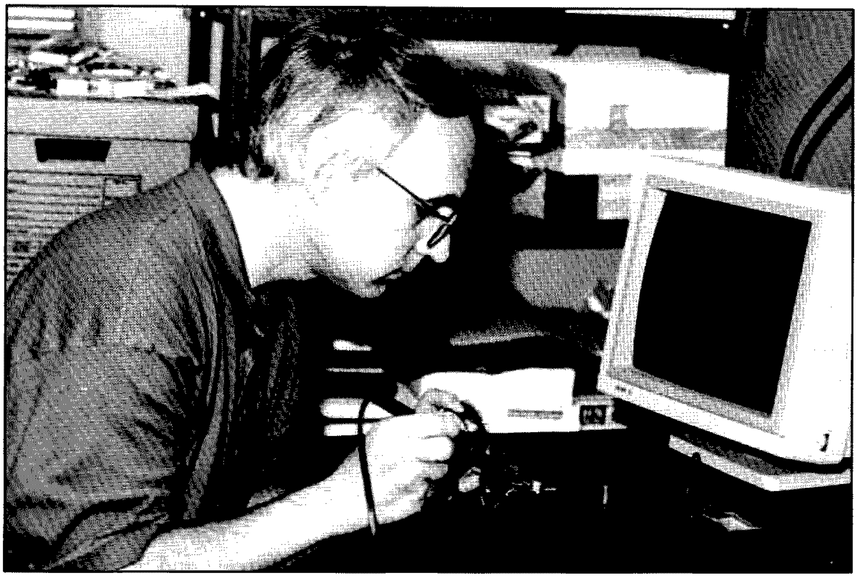

Photo A. Carefully wire the RS-232 lines between the modem and the computer. The wiring is different from standard modem communications.

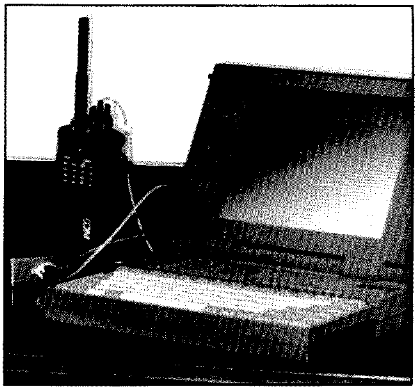

Photo B. The author has installed a Poor Man's Packet modem in a case and added a TTL/RS-232 converter to operate the modem through the PC serial port.

file. The PMP modem can also be adapted from parallel port use to serial port use with the addition of a TTL/RS-232 conversion circuit such as the MAX232 chip and a 7404 hex inverter (see Note 3).

My favorite modem program is SofTNC, written by Andy Payne (see Note 4). It is very similar to Poor Man's Packet (also written by Andy), but it has a couple of features which make it superior to PMP, most notably a keyboard buffer so keystrokes are not lost when a packet is being received. Additionally, SofTNC is already written to address the PC's RS-232 serial port rather than the parallel port.

Keying the Radio

The keying circuit requires the addition of a 2N3904 NPN switching transistor and 10k ohm resistor. The entire wiring diagram, including the RS-232 line connections to the PC, is shown in Figure 1. The software assembles and decodes packet transmissions

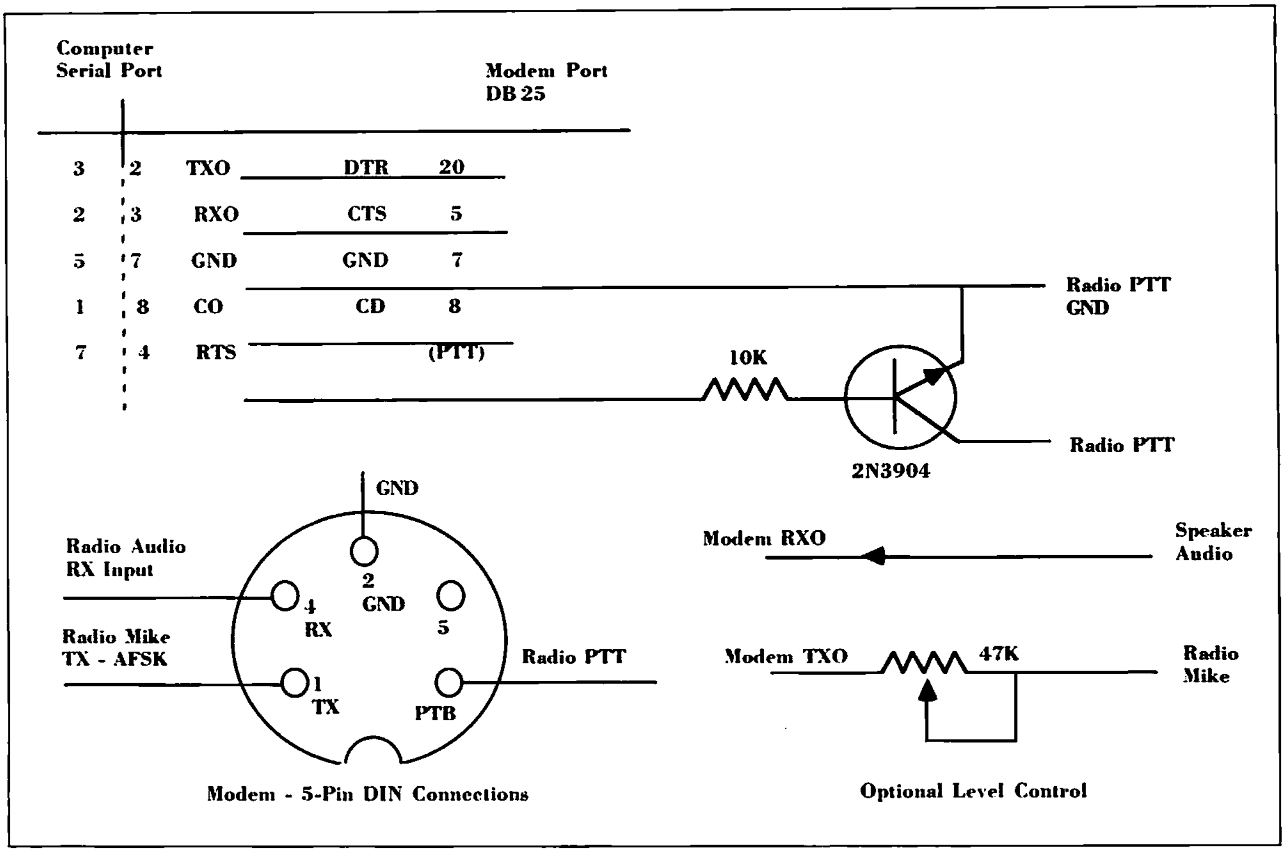

Figure 1. Wiring diagram. This circuit and computer connections will adapt Bell 202 modems for use with PMP, Baycom, or SofTNC. A variable resistor in the transmit output may be added to reduce audio level into the radio transmitter.

by the rapid switching of the serial port's handshaking lines. Be careful to follow the RS-232 port wiring diagram as it is different from normal serial communications! I have built the keying circuit inside the hood of the DB-25 connection cable on a number of modems so that no internal modifications of the modem are even required. On another modem I installed a five-pin DIN jack for the radio connection to the back panel of the modem, like many TNCs.

Either way, the modifications are non-destructive and the modem can still be used in its original configuration if necessary. The keying circuit shown here assumes the radio is keyed by switching the PTT lead to ground. If you use a hand-held radio such as the Icom, Yaesu, or Alinco variety that combine the PTT and microphone lead, you may need to refer to your owner's manual or call your radio's customer support line and ask for special instructions. Many times, all you need to do for these radios is split the PTT/mike line and add a 0.1 uF capacitor to the mike lead and a 1.2k ohm to 3.9k ohm resistor to the PTT lead.

Photo C. If you haven't experienced packet yet, maybe this project will give you a good excuse to try it.

Setting the Modem Configuration Switches

Most Bell 202 modems can be configured for either two-wire or four-wire use as a part of computer system use on dedicated telephone lines. You will need to set the internal switches on the modem as shown in the chart in Table 2 to operate properly. If your modem does not have the same switches or has other switches, try experimenting with different settings until you find a combination that works.

Testing and Troubleshooting the Modem

Once you have your keying circuit, your internal switches set, and your special modem-to-serial-port cable, you are ready to test your new packet modem. Don't be disappointed if it does not work correctly on first try. Often, an internal configuration switch needs resetting or only half of the modem will work on first try. If you can monitor packets on an active frequency but cannot connect to anyone, you probably have a problem with your keying circuit. Conversely, if your modem transmits but cannot connect to anyone, you probably have a problem with the wiring of the receiver circuit. If you have half the circuit working you are halfway home.

One easy way to check problems is to

```
# PTTPORT
    pttport 0x3FC 2 0
# TXPORT
    txport 0x3FC 1
# CDPORT
    cdport 0x3FE 128 1
# RXPORT
    rxport 0x3FE 16
```

Table 1. PMP Software changes: Change the following parameters in PMP.CFG to the values shown below. (This causes the software to address the "handshake" lines on the COM port instead of the Parallel port.) The addresses given are for COM1 serial port. For COM2, change the port addresses from 3FC to 2FC and from 3FE to 2FE.

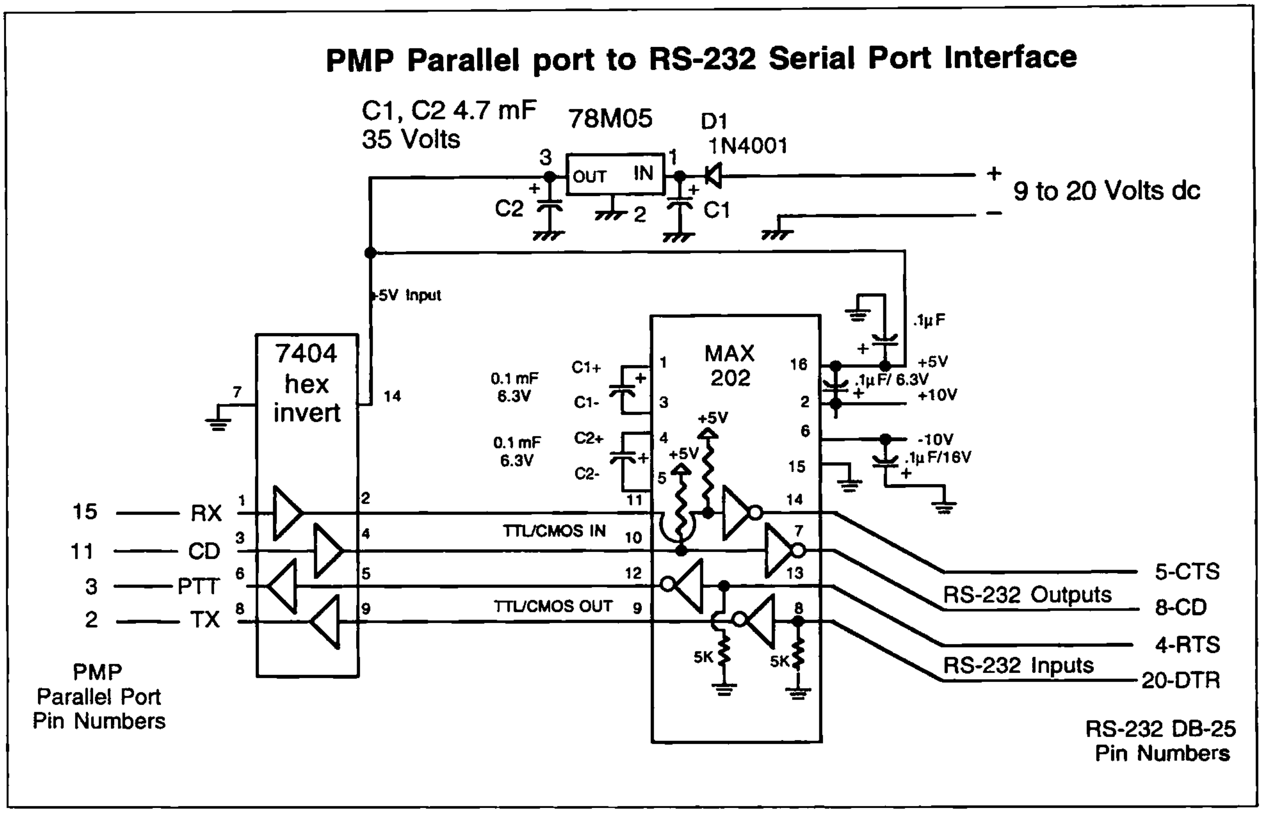

Figure 2. PMP parallel port to RS-232 serial port interface. Note: A MAX232 chip may be substituted for the MAX202 if 10 µF capacitors are used throughout.

monitor your RS-232 lines with either internal LEDS in the modem or an RS-232 line dual-color mini-tester, like the Radio Shack catalog number 276-1401. These handy little devices will help you figure out where to check for crossed or nonfunctioning lines. The chart in Table 3 shows how the LEDS should look during idle, reception, and transmission.

Another good tip is to monitor your transmitted signal. If your signal is too loud or distorted you may need to install a high-value variable resistor (47k, more or less) to adjust (reduce) the output of the modem into your transmitter.

This project is inexpensive, easy, and fun. It shows how easily a standard Bell 202 modem can be modified and used for packet radio. These modems often provide superior transmission and reception to standard TNCs. Even if you do not use this type of modem/software for all your packet activity, it makes a handy backup to your regular packet TNC station.

Notes

Note 1. The most current release of the program is version 1.5. I have used only version 1.2 and 1.4. Version 1.2 has a few bugs so try to use version 1.4 or later. Baycom 1.4 is available as shareware. It can be found at many sources and is included on a number of ham CD-ROMs.

Note 2. Poor Man's Packet is available from the authors on disk for $10, and from various sites on Internet. It can also be downloaded from the *73* magazine BBS at (603) 924-9343. PMP is also included on a number of CD-ROMs. Finally, PMP is available from me (Robert B. Whitaker KI5PG, 121 South Main, Suite 205, Victoria TX 77901) for a $2 duplication and handling fee. Please include a formatted blank diskette and a stamped return envelope.

For an extra $3 I will edit the PMP.CFG file to specify your call sign and RS-232 port. Be sure to include this information in your request.

Note 3. A PMP modem can be converted from parallel to serial port use by running the following lines through the MAX232 and 7404 hex inverter:

Parallel Line #		DB-25 Serial Line #
2	to	20 (DTR)
15	to	5 (CTS)
3	to	4 (RTS)
11	to	8 (CD)
18	to	7 (GND)

A full schematic for the TTL/RS-232 conversion circuit is available from the author.

Note 4. SofTNC is marketed as a commercial product by j•Com, which was recently bought out by Ramsey Electronics, Inc., 793 Canning Parkway, Victor NY 14564; phone: (800) 446-2295. It costs about $20.

On/Off	Name
On	Local Copy
Off	2 Wire Select
On	4-Wire Select
Off	Transmit Level= -9 dB
On	Request To Send (Forced On)
Off	Receiver Squelch (On)

Table 2. Modem configuration settings. (Note that your Bell 202 modem may have somewhat different settings than this. If your modem is different, try all the different settings and see which ones work best.)

RS-232 Line #		Idle	Receive
Transmit			
4 (RTS)	low	low	high
5 (CTS)	low	shifting	low
8 (CD)	low	high	low
20 (DTR)	—	—	shifting

Table 3. LED RS-232 activity. This chart shows the relative state of the RS-232 handshake lines during modem states of idle, receiving, and transmitting.

Parts List

Q1	2N3904 or 2N2222	Radio Shack	276-2016
R1	10k ohm	Radio Shack	271-1335
R2	47k ohm (optional)	Radio Shack (for TX level)	271-283

UPDATES

Number 14 on your Feedback card

CAT 1000 and CAT 300 Repeater Controllers

See the above-mentioned review of Computer Automation Technology's controllers (September 1994, page 26). Bob Schmid WA9FBO of S-COM Industries wrote us to point out that it is illegal to directly connect controllers without FCC Part 68 certification to the telephone jack. Attaching an approved coupler could in some cases be complicated, involving connections to the PC board. Thanks for pointing that out, Bob. Not all controllers are FCC Part 68 certified, so buyers may want to consider this.

Owen Wormser of C3I also took the time to write—to compliment this review and to point out that "C3I" is not the same as "C3I, Inc." C3I is the correct trademark tor the company mentioned in the review; the phone numbers are (800) 224-5137 (voice) and (703) 864-1382 (FAX). C3I provides options, products, and services related to the CAT family of repeater controllers. Thanks Owen.

Handy Randy

With reference to the above-mentioned article (October 1994, page 35), Figure 1 should show a wire connecting the coax braid to the bottom of L1. Without this wire, Randy will not be so handy.

HAMSATS

Number 15 on your Feedback card

Amateur Radio Via Satellites

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With all the news about the next high-orbit satellite, Phase 3D, and the many digital satellites now in orbit, we often forget the relative simplicity of operation possible through RS-10. For the newcomer just learning about space communications or the longtime hamsat-chaser looking for some easy yet enjoyable contacts via satellite, the Mode A transponder (2 meters up and 10 meters down) of RS-10 is the answer.

Unlike the single-channel FM operation available with AMSAT-OSCAR-21 and AMRAD-OSCAR-27, the Mode "A" linear transponder of RS-10 provides a more relaxed environment for satellite activity. RS-10 has been using the 2 meter uplink receiver in conjunction with the 10 meter downlink transmitter for many years since launch on June 23, 1987, from the Plesetsk launch complex in the former USSR.

The pre-launch designation of RS-10 was BRTK-10. This is a Russian abbreviation for "Equipment for Amateur Radio Satellite Communication." The ham components are an integral part of COSMOS 1861, a Soviet navigation satellite. As long as the larger spacecraft is operational and has power available for the amateur radio gear, RS-10 will be on the air. Although RS-10 has other modules including a 15 meter receiver and a 2 meter transmitter, these units are not in use. The 2 meter transmitter tends to interfere with COSMOS 1861 and the 15 meter receiver of RS-12 provides enough Mode "K" (15 meters up and 10 meters down) activity without using RS-10. Duplicate equipment incorporating slightly different frequencies is also on board COSMOS 1861 in the lorm of RS-11, which is held in reserve pending any RS-10 failure.

RS-10's orbit is described as low-altitude, circular, near-polar and non-sun-synchronous. It has an altitude of nearly 1,000 kilometers, giving a period, or time for one orbit, of 105 minutes. The inclination is 82.9 degrees. This means that it passes very close to the earth's poles as it orbits. An inclination of 90 degrees would travel directly over the poles. Some satellites have orbits that are sun-synchronous. They come over the same general areas each day at the same time and are usually oriented to stay in sunlight as much as possible. RS-10 does not. On a given day it may be traveling from south to north during evening hours. A month later the local passes will have shifted earlier into the afternoon. In this example, morning passes from north to south will have shifted in a similar fashion.

Photo A: Andy Mironov RK3KPK and his family in Moscow. Andy operates the RS-10 command station RS3A.

For most RS-10 enthusiasts there are between four and six passes a day ranging in duration from 10 to 17 minutes each. The maximum range between two stations wishing to make contact through RS-10 is about 6,700 kilometers for normal line-of-sight propagation. For East Coast U.S. stations, contacts into Europe are possible. For others, most of the North American continent is available.

Finding RS-10 is easy with any computer tracking program. Many simple programs for satellite tracking can be found on ham radio BBSs. More sophisticated programs can be purchased from organizations like AMSAT, The Radio Amateur Satellite Corporation (850 Sligo Ave., #600, Silver Spring MD 20910-4703), or R. Myers Communications (P. O. Box 17108, Fountain Hills AZ 85269-7108).

The RS-10 Mode "A" uplink passband goes from 145.860 to 145.900 MHz, with a corresponding downlink of 29.360 to 29.400 MHz. The 40 kHz of bandwidth allows many stations using CW or SSB to make contacts on discrete frequencies without bothering other nearby users. The transponder is like a wideband linear repeater.

Equipment

Station equipment for RS-10 operation can be very simple. Some users have beam antennas and sophisticated satellite rigs, but most do not. A modest yet functional setup includes some form of 10 meter receiver or transceiver capable of SSB and CW. An outside dipole makes a good antenna. For the 2 meter uplink, a multimode transceiver is best, but not always necessary for CW operation. Many 2 meter FM rigs can be used for CW, although some have excessive chirp when keyed via the microphone line with a code key. A quick on-the-air experiment with another station equipped for 2 meter SSB reception or operating through the satellite transponder will provide a good test.

Most omnidirectional 2 meter antennas perform well on the uplink when used with 10 to 25 watts. Stations with 2 meter beams should avoid running excessive power. A few watts to an array used with the high-orbit satellites is quite enough for solid contacts through RS-10. While a simple quarter-wave ground-plane antenna may do well, other designs worthy of note include the turnstile, Lindenblad and quadrafilar helix antennas.

As with all hamsats, emphasis should be placed on station upgrades to the receive side. Older 10 meter rigs may require a preamp for satisfactory reception. A home-brew MOSFET unit or commercial GaAsFET device will do equally well for 10 meter work. Some newer rigs already have excellent front ends. A preamp may do little

Photo B: A QSL card from the RS command station RS3A in 1991.

Photo C: RS-10 ROBOT QSL for a contact made three days after the satellite's launch in 1987.

more than bring up the noise level.

Different types of receive antennas may perform better than the dipole in some locations. Having a dipole, a vertical and a horizontal loop connected through a coax switch is a method employed to pick the antenna with the best reception during portions of a pass. At the horizon, the vertical may have a better signal while the horizontal loop may be optimum when the satellite is overhead.

The telemetry beacon on 29.357 MHz provides both information on satellite health and a good signal to monitor to tell when the satellite is within range. Data on decoding the telemetry can be found in the ARRL publication *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC or *Decoding Telemetry from the Amateur Satellites* from AMSAT by G. Gould Smith WA4SXM. Both books are available from AMSAT at the address noted above or via phone: (301) 589-6062.

RS-10 has a computerized ROBOT autotransponder that will issue contact serial numbers when correctly called using CW on 145.820 MHz. The corresponding downlink is 29.403 MHz. To make a contact with the ROBOT, first ensure that the uplink signal is properly centered in the ROBOT's receiver. This is done by transmitting a carrier on 145.820 while listening on 29.403. Move the transmit frequency a few kHz up and down 'til a steady tone is heard on the 10 meter frequency. Then call the ROBOT with the best CW you can generate using the following sequence: RS-10 DE WA5ZIB AR. Use your own callsign and send the "AR" as a continuous di-dah-di-dah-dit. The best speed to use is 15 to 20 words per minute. If the ROBOT got everything correctly it will respond with your call, a short message and a serial number. Sometimes the RS-14/A-O-21 CW beacon which transmits on 145.822 MHz can be heard through the RS-10 ROBOT channel when within range of RS-10.

QSLs for ROBOT contacts are available through DF4XW or Andrey Mironov RK3KPK. Cards to "Andy" should be sent to: ul.V-Voloshinoj, d.11, kv.72, station Perlovskay, 141014, Moscow region, Russia, C.I.S.. Andy operates as RS3A at the RS Command Station in Russia. The equipment there consists of a 100 watt uplink transceiver that feeds a ground-plane antenna. The downlink receiver is an older variety called an R250M2. It has 20 tubes and weighs about 95 kilograms. A three-element yagi is used for downlink reception.

"It's a great way to get involved with satellite communications with little effort but very satisfying results."

RS-10 also has a special channel that operates like the ROBOT frequency for CW, but without the computerized autotransponder. The uplink is 145.850 MHz with a downlink of 29.350 MHz. Sometimes when the main transponder is off, single-channel CW contacts can still be made via this special frequency pair.

If you have never made a contact through RS-10, give it a try. It's a great way to get involved with satellite communications with little effort but very satisfying results. If you have been chasing exotic modes on other hamsats, come back and check the activity on RS-10. It's a great change of pace and brings back memories of what it was like to work through AMSAT-OSCAR-6 over 20 years ago when Mode "A" was the only amateur transponder in the sky.

Other publications from AMSAT that can provide more useful information on RS-10 include *The RS Satellites Operating Guide—RS-10/11 and RS-12/13* by G. Gould Smith WA4SXM and *How to Use the Amateur Radio Satellites—Fourth Edition* by Keith C. Baker KB1SF.

Number 16 on your Feedback card

CARR'S CORNER

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AM BCB QRM? Try a Loop Antenna!

This month we are going to take a little different tactic, and in the process serve both our ham and SWL readers. Several months ago we looked at the issue of dealing with AM broadcast band (540-1700 kHz) interference to high frequency ham band receivers.

A couple of readers wrote to me and wanted to know how to deal with AM BCB interference while listening to distant stations within the AM BCB. As a result, we're going to talk about loop antennas this month. The same techniques, usually with fewer turns on the loop, also work on 160 meters, 75/80 meters and 40 meters . . . all crowded bands with problems similar to the AM BCB case.

One of the big frustrations of the AM broadcast band (BCB) DXer is the terrific QRM interference from thousands of North American, Caribbean, Central and South American, and even European (when conditions are right) stations. The 5 and 10 kHz heterodynes from co-channel, split-channel and adjacent channel stations can be deafening. If your receiver is not up to the highest performance levels, then the problem is even more noticeable: The front-end overloads and performance goes down the drain. The traditional response to large numbers of co-channel and adjacent channel interfering stations is the directional antenna. On the HF shortwave bands (and higher) it's relatively easy to build a yagi or quad beam to give pretty good directivity. Heck, even an ordinary half-wavelength dipole has a pair of nulls (one each off either end), so it has a "figure-8" pattern. One of the nulls can be positioned to reduce the signal level received from the undesired station. Rotatable dipoles are even possible for the mechanically inclined. But on the AM BCB, which runs from 540 kHz to 1,700 kHz, that half-wavelength dipole is 275 to 870 feet long . . . hardly practical for anyone owning less than a Texas farm!

So, enter the small loop. There is an antenna that provides a figure-8 antenna pattern, is easy to construct, and can be installed inside the house (although outside might be better). The small loop antenna is a marvelous creature (a small loop has an overall length less than 0.2λ). Figure 1 shows the basic form for the loop. This version is square, but round, hexagonal and octagonal shapes are also possible. The square loop is generally easier to construct, however. Dimension "A" in Figure 1 is the length of each side of the loop, while dimension "B" is the depth of the winding (both expressed in inches). The depth dimension can be either flat-wound (i.e. all turns in the same plane), or depth-wound. Although one expert tells me that the depth-wound version is superior, I was unable to tell the difference in some practical side-by-side tests that I performed one weekend not long ago.

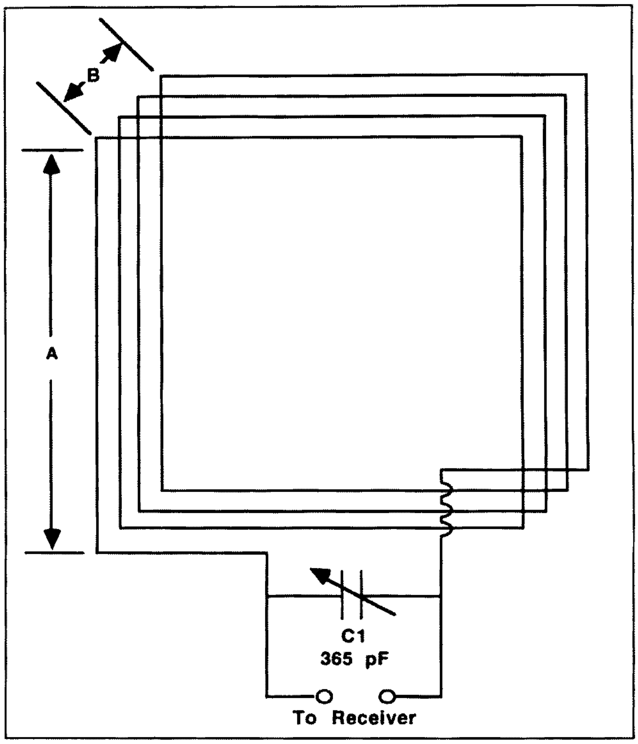

Figure 1. Schematic of the square loop antenna.

For a practical AM BCB antenna, the dimensions that I used were 24" square by 1" deep. There are 14 turns of wire in the AM BCB loop. For lower frequencies use more turns, and for the lower shortwave bands use fewer turns. Either experiment with the number or use the Antlers software to calculate the parameters.

There are two ways to wind the loop. Use either enameled magnet wire or insulated hookup wire (#22 for either type) to make the turns. Or, if you prefer, use 14-conductor computer ribbon cable to make the loop. Cross-connect adjacent wires so that a continuous circuit is formed (see the detail shown in Figure 2).

Some people connect the loop directly to the receiver through a piece of coaxial cable. One side of the loop (e.g. "A") is connected to the shielding outer conductor, while the other side is connected to the coax center conductor. Unfortunately, untuned loops are not terribly efficient, so this arrangement produces a very low output signal level. The output can be boosted 100-fold by the simple expedient of tuning the loop with capacitor C1 (Figure 1). An ordinary single-section AM broadcast variable (365 pF, 380 pF, 400 pF, etc.) will tune the entire AM BCB plus some. Suitable capacitors can be found in the catalog of Ocean State Electronics (POB 1458, 6 Industrial Drive, Westerly, RI, 02891; 1-401-596-3080). Keep in mind that the capacitance of the coaxial cable can be rather large, especially for long runs of cable, and it adds to the capacitance of the circuit.

Photo A. A home-brew square loop.

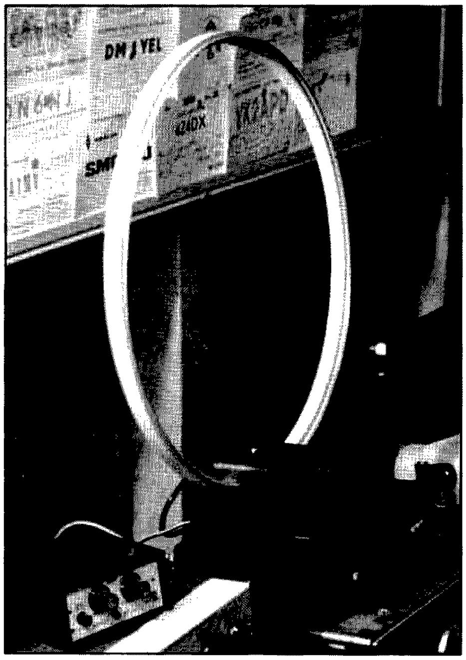

Photo B. An embroidery-hoop loop.

A Better Approach to Loop Design

A second approach to loop design is shown in Figure 3. In this antenna, there are two concentric loops. The resonant loop is the same as discussed above in Figure 1, but without the electrical connections to the receiver and transmission line. A coupling loop is used to connect to the transmis-

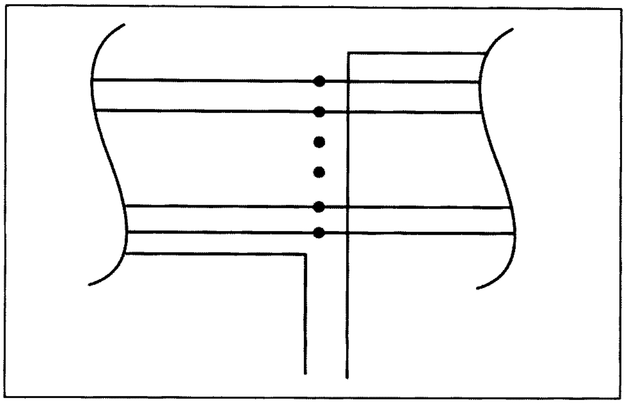

Figure 2. Cross-connection scheme when computer ribbon cable is used.

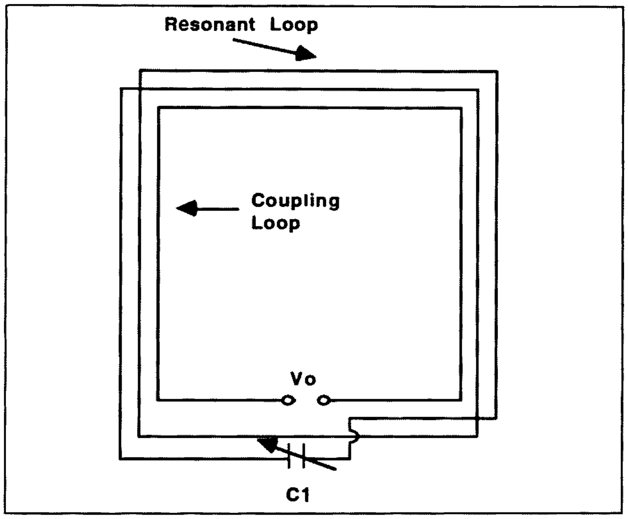

Figure 3. Use of a one-to-two-turn coupling loop improves performance of the loop antenna.

sion line instead. The coupling loop is one or two turns of wire wound with the resonant loop. If you use computer ribbon cable, then use 16-conductor cable instead of 14-conductor. Use 14 conductors, cross-connected as per Figure 2, for the resonant loop. The coupling loop is made from two adjacent turns (cross-connected) from one edge of the cable.

Using the Small Loop

The pattern for an ideal loop is shown in Figure 4A. It is the standard figure-8, similar to the half-wavelength dipole. Note, however, that the nulls are broadside to the loop, not off the ends. The maxima are off the ends instead.

Figure 4B shows one way to use the loop. Keep in mind that the point is to increase the signal-to-noise ratio (or, actually, the desired signal-to-undesired signal ratio). It is in the SNR improvement that better reception becomes possible. Position the null in the direction of the undesired station, even if it costs a little bit of gain in the direction of the desired signal. The idea is to reduce the level of the undesired signal as much as possible. You don't need to know where the undesired station is located—it is only necessary to rotate the loop until the dirty, smelly, bad guy is nulled.

Some people report that the physical location of the loop is sometimes important. My home has a split-foyer design, and I used the loops on the main floor, half a level above ground grade. But a friend of mine, who likes to listen to a distant country music show by skywave on Saturday night (The Grand Ol' Opry), tells me that it works a lot better on his basement floor than upstairs. The reason, I suspect, is that the levels of the interfering signals are lower, or possibly there is a skywave angle of arrival issue involved. At any rate, there is enough variation to make it interesting to do some experimenting with location.

Some Loop Examples

Two of my home-brew loop antennas are shown in Photos A and B. The version in Photo A is flat-wound of computer ribbon cable. Note that the cable is folded over at each corner in order to turn the corner. The cable is held to the wooden frame by thumbtacks. These tacks do affect the operation of the loops, according to good theory, but the effect was so minimal that I didn't notice anything. The wooden frame is made from picture framing stock purchased at a hobby and crafts store. This material comes in 12" to 48" lengths, and is beveled 45 degrees on each end, with a tongue and groove joint to allow a solid junction between the pieces. A little carpenter's glue on each joint, and a few hours under clamping (with a vise or C-clamp) made the frame very solid.

The support for the frame was made from a piece of 1X2 lumber stock. Other people have used 1" dowels and broom handles for this purpose. The 1X2, however, makes it easy to attach the capacitor, a small piece of perfboard, to make electrical connections between adjacent conductors (if com-

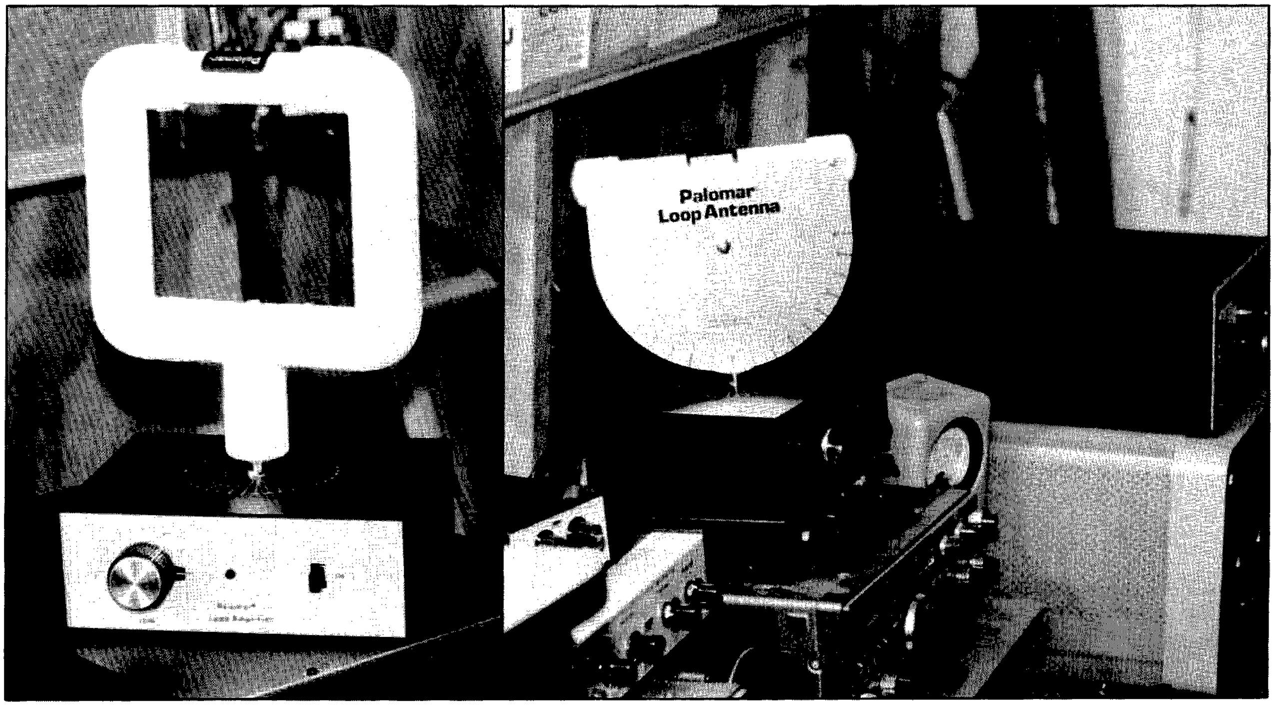

Photo C. Two commercial loops: 1) square; 2) loop-stick.

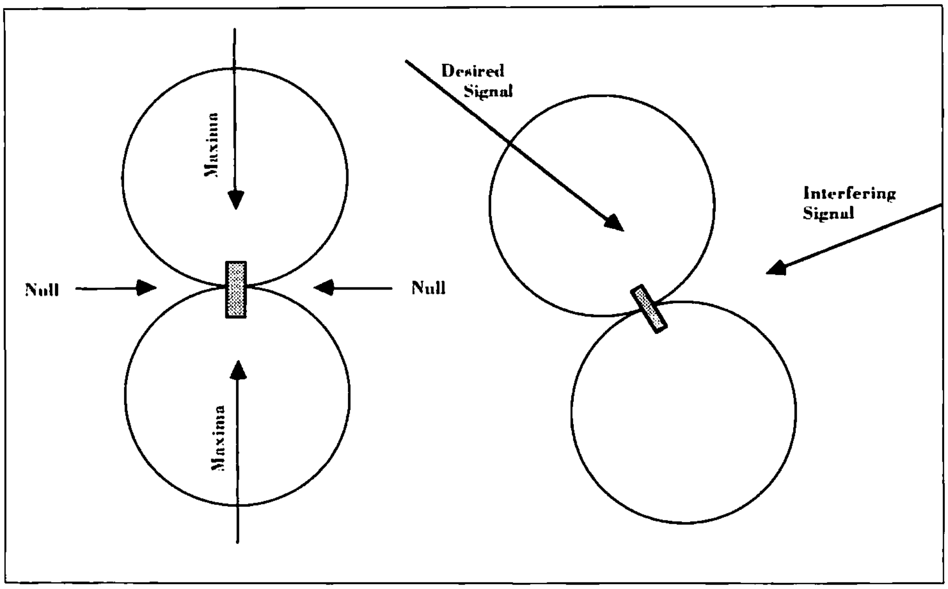

Figure 4. A) Azimuthal pattern of the loop (shown from above). Note that the nulls are broadside to the loop winding. B) Use of the loop's nulls to reduce an undesired signal.

puter ribbon cable is used), and so forth. If you want to make a better antenna than is shown here, put the capacitor and connection block inside a shielded aluminum box. A plastic knob is used to tune the capacitor, regardless of the construction method.

The loop antenna shown in Photo B is a clever little design made from an embroidery hoop. Those hoops consist of an inner and outer circle that fit together. The outer loop is split at one point, and is fitted with a screw and wing nut to permit adjustment when cloth is placed in between the inner and outer pieces. When making the loop antenna from computer cable, place the ribbon cable between the two pieces of the hoop, and then tighten the screw to hold it in place. Don't worry if a little bit of the ribbon cable overhangs the edges of the embroidery hoop. A utility box (metal is better) is used to support the hoop loop and house the connections and tuning capacitor.

Photos C-1 and C-2 show two commercially available loop antennas, made by Palomar Engineers (Box 462222, Escondido, CA, 92046; 1-619-747-3343). Both loop elements are available in different frequency versions from VLF up to the shortwave bands. The box they interface with is the LA-1 loop amplifier (a preamplifier and tuning capacitor) by the same manufacturer. Consulting the catalogs of most shortwave receiver dealers will show other brands of loop antenna as well.

Conclusion

The small loop antenna performs the function of nulling low frequency shortwave and AM BCB interference quite nicely. They are easy to build, and easy to use. Additional types of loop, as well as some unusual applications, are found in my book *Joe Carr's Receiving Antenna Handbook* (HighText Publications, 1-800-247-6553). The Antlers (MS-DOS) software is $20, and the Antlers for Windows is $30. Contact me at P.O. Box 1099, Falls Church, VA 22041 if interested.

QRP

Number 17 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
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Just before the holiday season begins, let's get into some reader mail and tie up some loose ends.

HW-9 Modification

First out of the mail bag is an interesting modification for the Heath HW-9 transceiver. This modification comes from Gerald Fortler W7JXQ. Gerald writes the following:

"The HW-9 Transceiver by Heathkit is a very fine little rig. After all the modifications were added over the years, it still didn't seem to have the sensitivity I thought could be had. It seems Heath did not incorporate an RF amplifier in this rig.

"At first I didn't see how I could add a preamp and get it out of line when keying the transmitter. A study of the schematic provided the answer. Diodes D301 and D302 are biased on the +R voltage during receive, by a positive voltage at the anode. That voltage is absent during transmit, and the diodes block any RF to the receiver's first IF and the rest of the receiver.

"Locate C302 on the schematic. (See Figure 1.) You will find it standing on end, near T301. Now, carefully cut the lead of C302, leaving it long enough on both sides to tack-solder short wires to. (See Figure 2.) This will be your input and output connection to install the preamplifier. Figure 1 is the schematic for the preamp. Use a 2N5179 or any other low noise high frequency NPN transistor you may have. The circuit is small and lightweight. I just used point-to-point wiring on a 1" x 1-1/2" piece of perf-board. All resistors are standing on end for maximum circuit density. The RFC can be anything from 22 µH to 1 Mh; its value is not critical.

"Oh, yes, with the power off, and using an ohmmeter, measure to ground each side of the C302 capacitor's clipped wires. One side will go to ground (through T301); make sure this is the "output" of the preamp. The circuit will give you about 12 dB of gain and the S-meter really responds now! The noise floor (quiet) remains the same on my HW-9.

"Try it! If you have any trouble, you can always connect the leads to C302 back together. But, check your wiring first. This circuit really works great for me."

Since I no longer have an HW-9, I can't speak about the performance of this modification. If you are interested in doing more modifications to the HW-9 and HW-8, there are still some copies of the *HW-8 Handbook*. They're $11 and that includes shipping. They're available from me at the above address.

30 Meters

One of my favorite bands for CW is 30 meters. It's a great combination of 40 and 20 meters. Best of all, there's no SSB on the band to get in your way. It's a CW and digital operator's delight!

I happened to pick up a copy of the Northwest QRP Club bulletin and noticed a really interesting 30 meter transmitter. What makes this rig so slick is the way the frequency is controlled.

A VXO is used to control the frequency, but with a twist. In this rig, the crystal is operated at 5 MHz and is doubled to the final output to 10 MHz. The crystal used is an easy-to-obtain 5.0688 kHz computer crystal.

Instead of the usual transistor oscillator, a transistor array IC is used, a CA3086. A third twist to the VXO is the use of several coils in series with the crystal. At first, it would seem to be an easier method to use only one coil, instead of several, but that's one of the reasons why we can get a VXO spread of 35 kHz!

Another feature that is *unusual* is the use of a power MOSFET in the PA. The MOSFET will generate a rather hefty 3 to 4 watts of power. That's more than enough juice to work worldwide on 30 meters.

As in most QRP transmitters, after the frequency doubler the rig operates straight through. On 30 meters, we have a really slick way of making the tuned circuits easy to build and adjust—use 10 MHz IF cans!

Other features of this rig included a spot switch, provision for receiver muting, and antenna switching. The rig's keying is very good.

This rig is very different from most of the transmitters we have seen in the past. The VXO is contained within the transistor array IC. The output of the VXO is tuned by one transformer. The output is then routed to the driver, and then to the power MOSFET PA. A trimmer pot sets the bias of the MOSFET. The bias is set with your voltmeter, not with a scope.

Of course, the best part of this transmitter is it's available for $30 from Dan's Small Parts, 1935 South 3rd West #1, Missoula MT 59801.

I built up one of these rigs and found it went together quite easily. In fact, it's one of the best kits I've seen from Dan. The instructions take you to one stage and then another. You build up one stage, say the VXO, and then test it before moving on to the next. This way, by the time you get to the PA, you'll be 100 percent sure you'll have a working transmitter. If you can't get one of the stages to work, there is no need to proceed to the next until you have found the trouble.

After all the stages are assembled on the PC board, the only adjustment is the bias to the power MOSFET. A quick tweak of the trimmer is all it takes.

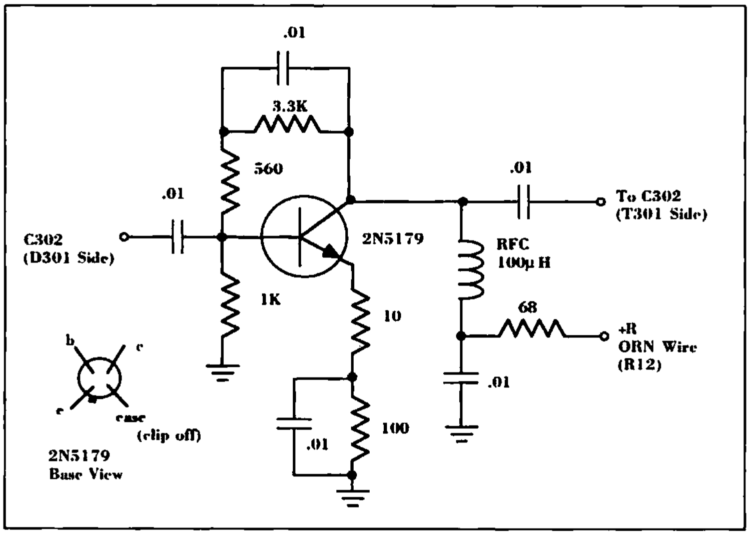

Figure 1. Preamp schematic.

I'm vary much impressed with the way the little transmitter performs. Although band conditions were rather poor, I was able to work just about anything I could hear. I used my old Drake R4B for receiving. One of my QSK boards did all the T/R switching. Although the rig comes with an electronic T/R switch, I choose to use my system.

With 3 watts of RF going to the antenna, the PA gets slightly warm to the touch. A small heat sink is necessary to protect the device from overheating. The heal sink is not provided with the kit. Radio Shack sells one lor about a buck that works just fine. A hunk of aluminum would work just as well, too.

On my unit, I was able to get about 30 kHz worth of VXO spread. That's not bad at all for one crystal. In fact, it covers just about all the CW part of 30 meters. On the higher end you'll find some packet, AMTOR and perhaps some RTTY, but most of the CW is on the lower end.

With the build and test-as-you-go instructions, this is a perfect beginner's kit. Of course, you should be able to tell one end ol a diode from the other and know basic soldering skills before you start. Other than that, it's an easy kit to build and get working. You'll have a lot of fun with this rig on 30 meters.

Have you built one of the NN1G rigs? I have and will have a complete rundown on this guy in an upcoming issue. But, there have been some reports of an unstable transmitter. From the Internet, I picked this up from Daniel Wee, who has fixed the problem. Daniel writes the following via Internet:

"Here are the mods I did to fix the TX section for the NN1G. There are 2 primary requirements, properly tuning the 2 IF transformers on the TX board is critical.

You will need:
a) 36 pF capacitor
b) Some ferrite beads, small ones
c) SWR and watt meters
d) >20 MHz scope (probably optional)

"First of all, determine if you have the problem as mentioned in previous mail. If you do, read on.

"Connect your antenna, not a dummy load, to a working rig. Tune the antenna to resonate at 20m if it's a multibander. Use an ATU if you have one. Once you know your antenna is resonant AND matched at 20m, connect your NN1G to it and note your SWR. Do not retune the ATU since it is already resonant. if you see an SWR exceeding 2:1, then you are likely to be having the same problems as I did.

"Take the ceramic 36 pF and cut one leg to about 3mm and tin It. Look at the second driver transistor (2N2222), the one closest to the PA transistor. Tin the top of the transistor after cleaning it. Solder the shortened lead of the 36 pF capacitor to the top of the transistor. Now, slip a couple of ferrite beads over the other lead. I noticed that I needed a few to cut down the spurs to a reasonable level. Tin one of the corners of the IF transformers and solder the longer lead of the capacitor to it, effectively grounding it.

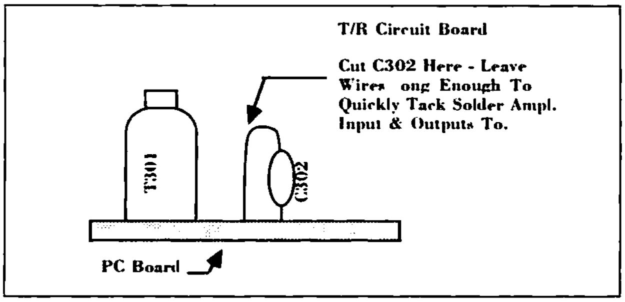

Figure 2. Connecting the preamplifier.

"Now you should see a much lower power output. In my case, I cut some tracks at the bottom of the board and put ferrite beads on the base connections of the driver transistors' bases, but I think this is unnecessary.

"Retune the IF transformers for a minimum SWR reading. This should take some time. Then turn the audio volume all the way down. There should be no more sharp clicking when keyed. Instead, there should be a 'gentle' click with no hiss. Try this out throughout the band to see if instability occurs. If it does, retune the IF transformer lor more stability.

"If you have a scope, put it to the output at the antenna. Remember, until now, *no* dummy loads. Be sure to have a flat SWR if possible, as in my case, or at least the lowest possible. Key down and adjust the transformers for the most sinusoidal waveform. Do not get greedy for amplitude. Go through the band to see if the waveform is stable. You should be using a scope of more than 20 MHz for this purpose.

"Finally, when all is set, remove the scope. Remove the antenna and leave it disconnected. Key down, you should hear a clean sidetone, no hissing noise. There you have it. Keep leads as short as possible at all times."

Number 18 on your Feedback card

HAMS WITH CLASS

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Nonverbal Communications

Before introducing Morse code into the classroom for my sixth, seventh, and eighth graders, I set the stage for having some real fun by doing some activities that emphasize nonverbal communications. First, we brainstorm different methods that people use to communicate. The spoken or written word is not the only method that humans have devised to exchange messages or thoughts.

The children discuss the need for other means of communicating. People who speak different languages; blind, deaf, or mute people; or folks in emergency situations are often in need of unique ways to communicate. Most youngsters will recognize that Braille, sign language, smoke signals, dance, music and art are ways that people can exchange feelings, thoughts, or information.

Depending on the age group you are working with, there are lots of fun activities to do to make the children appreciate the value and creativity involved in nonverbal communication. Most young children are aware that boats often use an international system of flag signals. The various colors and patterns form different messages and function like a language. A flag divided into a red and yellow triangle means "Man overboard!" Perhaps your class would enjoy making up their own signals along with corresponding designs to go with it. They can make flags and have the class try to decode their messages. Play a game where no one may speak; they may only get information from their classmates by learning the meanings of their own coded language.

Many of the older children have seen movies where ships send Morse code to convey information. We discuss the on/off principal used in digital technology such as computers and CDs. The kids often point out the use of smoke signals or flashing a shiny mirror or flashlight with the on/off principle.

Photo A. Sixth-grader Mike enjoys building projects in our nonverbal unit.

In our intermediate school in Staten Island, New York, the seventh graders are introduced to simple circuits. There are numerous construction projects you can use with the class so they can practice Morse code. Kenny Mann, who conducts numerous science workshops for teachers, uses the following activity successfully with kids in the middle grades:

Materials: two DD batteries, or two D batteries and two battery holders, #22 electric wire, 1.5 volt light bulb, light bulb holder, and a single-pole switch.

Procedure: Have the students set up the materials in series by connecting the wire to the positive pole of one battery and from there to the negative pole of the second battery. Complete the circuit via the switch and the light bulb in its holder, ending at the negative pole of the first battery.

The bulb will light up. When the switch is opened, the circuit is broken and the bulb is switched off. By moving the switch back and forth, students can make the bulb go on and off at will.

After you've taught the letters of the code, have the children send brief messages to each other. I use the buddy system in my classes. Some of the children use code practice oscillators, some use the light bulb circuit, and others use flashlights.

Have a chart showing the symbols for the dry cell/battery, the light bulb, open and closed position of the switch, and the wire. Next, have them draw a diagram of the circuit they set up. Once they know the symbols, they'll have fun reading the diagram—which is another way of communicating without words.

After a unit on nonverbal communicating, most of the children agree that it's fine for sending brief messages, but nothing beats a one-on-one conversation for expressing moods or emotions.

With the start of a new school term, think about including at least one new unit or activity into your classroom. No matter what subject you teach, it's more fun for everyone when the teacher is excited and stimulated. Be sure to upgrade your materials and expand your repertoire each term. Write to me so we can share any new ideas you are using this term that are successful. Have a great school year! 73

Photo B. Eighth-grader Nicole Spitale KB2OJA, eighth-grader Molly Horne, and seventh-grader Yolanda Tammaro KB2PYH help set up materials for practicing code.

HOMING IN

Number 19 on your Feedback card

Radio Direction Finding

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Testing Motron's Transmitter Fingerprinter

According to many hams, Southern California has a reputation for being the repeater-jamming capital of the world. As someone who has traveled and talked to many repeater owners and users, I think that reputation is undeserved. The sad truth is that you can find examples of illegal repeater use in big cities and small towns everywhere.

With hundreds of coordinated 2 meter repeaters between Santa Barbara and the Mexican border, hams here can be proud that only a handful have ongoing problems with jamming, bootleggers, and unidentified transmissions. The rest are full of friendly and helpful hams who seldom face these problems.

Of course, there are occasions when nets and round tables on even our "cleanest" repeaters are brought to a halt by carriers, tones, and cuss words. When a phone call goes out to a radio direction finding (RDF) team, the job is not easy if there are many perpetrators in scattered locations. It would be a huge help to be able to separate and identify which transmissions come from which source.

Just Like Snowflakes

We all know that every human is unique and can be identified from all others by differences in the skin patterns on the fingertips and DNA in the cells. These methods require the person to submit to examination or testing. When this is not possible or desired, a voiceprint can be done from a distance, without the knowledge of the subject, at the cost of greater uncertainty.

Similarly, every radio transmitter is unique. You cannot read the serial number on its nameplate from a distance, but you can identify it by analyzing, with sufficient precision, the characteristics of its signal. Differences in signals, however slight, are always present due to differences in individual parts and the randomness in factory testing and tuning techniques.

You may have heard reports of unique transmitter "signatures" and a technique called "fingerprinting" to identify rigs used for illegal activities and to apprehend their owners. What these reports usually leave out is the fact that this technique was invented by a ham and such equipment Is now available for purchase.

A Sleepless Experimenter

When I spent nine months on assignment in Seattle back in 1972, the city's most popular repeater was run by Phil Ferrell W7PUG, an engineer at The Boeing Company. Today, this repeater is as popular as ever, Phil is K7PF, and he has retired to work on his own pet projects.

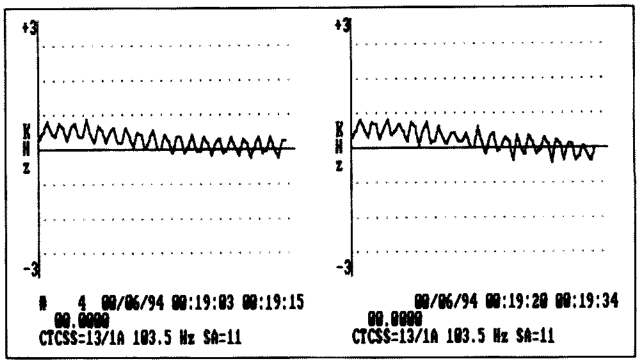

Figure 1. Two consecutive transmissions from a crystal-controlled repeater transmitter. Subaudible tone modulation (CTCSS) is plainly visible. TxID-1 computes and displays the CTCSS frequency below the trace.

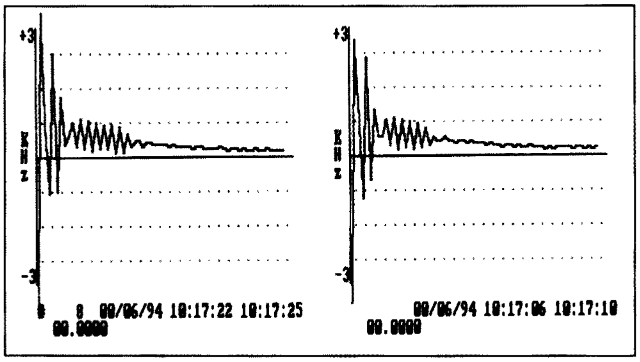

Figure 2. Two consecutive transmissions from the same FT-530 handie-talkie on the same frequency. Except for the ringing duration, the fingerprints are almost identical.

In the mid '80s, when unidentified signals appeared on the Seattle repeater Phil decided to fight back by using his knowledge of signal analysis. He reasoned that most of the offending transmitters were owned by licensed hams and could be identified by comparing their signals to those of regular and occasional repeater users.

The first design challenge was to figure out what signal characteristics to look at. "I had heard FM transmitters come on the air on top of one another," says Phil. "There would be a heterodyne with a chirp or quickly warbling tone at the beginning, as the phase-locked loop (PLL) settled on frequency. I researched PLL theory, which goes into a branch of math involving Gilbert transforms. That wasn't helpful, so I tried looking at it as a low-bandwidth FM phenomenon."

After some experimentation, his transmitter fingerprinting scheme took shape. It takes 2,048 instantaneous frequency samples at 100 microsecond intervals at the beginning of a transmission, then averages and filters this data to display and record 64 super-samples of frequency versus time.

"Amplitude and multipath don't have much effect," says K7PF. "It's a robust technique and works under almost all conditions. Even on signals of -120 or -125 dBm, when the audio is almost unintelligible, the low bandwidth of the system gives a pretty decent fingerprint."

Photo A. All you need to take transmitter fingerprints is a suitable receiver and a computer with the TxID-1 hardware and software installed. Not shown is an optional tape recorder for documenting audio and fingerprints simultaneously.

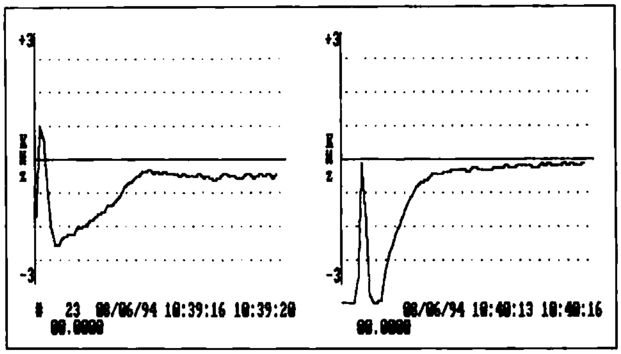

Figure 3. These two HTX-202 transceivers were bought at the same time, but have distinctly different fingerprints. They were set for the same power level on the same frequency

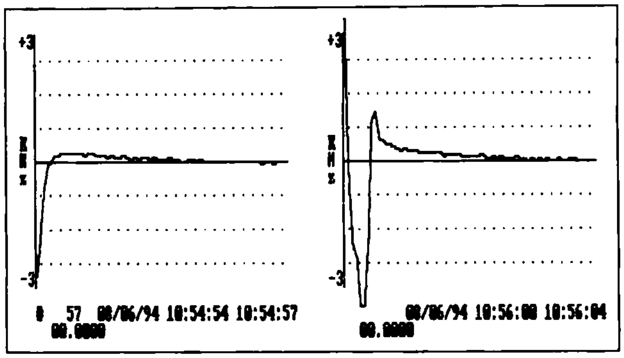

Figure 4. In a rapid-exchange QSO, this TH-78A produces consistent fingerprints like the one at left. If the rig sits for a few moments until the battery-saver feature activates, the next transmission looks like the trace at right.

There were distinctive characteristics on every radio he tested, even those of the same model. "I was showing the system at a club meeting and a husband and wife stood up," he goes on. "They both had brand-new Alinco handhelds with adjacent serial numbers. He told me flat out he thought they would have identical fingerprints. I was standing there kinda sweating and said, 'Well, I don't think so, but we'll take a look.' I finished the talk and got to the demonstration time and they immediately leaped to their feet. We checked the rigs and they were like chalk and cheese, totally different.

"A small percentage of rigs have two or more fingerprints. Theoretically, there are two predictable routes for PLL lockup. It's unlikely a given radio would be set up so it could take both routes, but it can happen." A rig's fingerprint may change slightly as you tune different parts of the same ham band. Dual- and multiband VHF/UHF rigs have completely different prints on each band.

K7PF soon realized he had a marketable signal identification system. "In a rare moment of greed, I ran it past the Boeing patent staff," he says with a chuckle. "That turned out to be a good move." Transmitter fingerprinting is now patented and assigned to Boeing, who sees to it that nobody makes commercial use of this idea without compensating Boeing and K7PF for it.

Next, FCC heard about fingerprinting and asked for some of Ferrell's equipment to evaluate. About this time, Don Moser AA7Y of Motron Electronics heard about the system at the Sea-Pac ham convention. K7PF showed AA7Y his breadboard and they worked out a deal for Motron to manufacture the circuit boards for Ferrell's FCC contract and to market the finished product, called the TxID-1, to the public.

Dozens of 78s

Phil's description fingerprinting made sense to me, but I was a bit skeptical at first about just 64 supersamples providing positive identification of like-model transmitters. For a rigorous test, I decided to take TxID-1 to a meeting of the 78's Amateur Radio Club. This group was formed to teach the arcane art of programming the

Kenwood TH-78A handheld to new purchasers. Dozens of TH-78s and other HTs would be there. Could TxID-1 display the unique features of many rigs of the same type?

Motron's TxID-1 system consists of the data acquisition and control board that plugs into the expansion slot of an IBM PC or compatible computer, an interface board, and a PC software program written by George Hadley N7SNI. TxID-1 connects directly to the receiver's discriminator and includes its own fast squelch circuit for uniform timing.

For this experiment, I mounted the main board in WB6UZZ's Compaq Portable 286 PC and connected it to a Bearcat BC210XL scanner (Photo A). The interface board (Photo B) plugs into the TxID-1 main board and has connections for receiver discriminator (mandatory) and AGC (optional). The BC210 is easy to adapt to TxID-1. There is plenty of room inside, RCA jacks mount readily on the steel rear panel, and its discriminator tap-off point is easy to locate.

Discriminator polarity and voltage swing differ among receiver models. To ensure that TxID-1 accurately displays the instantaneous frequency, you must calibrate the discriminator frequency-versus-voltage curve in 1 kHz steps. I used a TS-700A VFO-controlled rig and a VHP frequency counter to get the data for the BC21ØXL passband in about 10 minutes.

With this data, running OPAMP.EXE (supplied on the program disk) calculates values of two resistors to set gain and polarity of the input operational amplifier on the TxID-1 board to match your receiver. I ran the program, found the resistors in my junkbox, and soldered them to the supplied component header in less than 15 minutes. Note that the whole procedure must be done over if you change receivers.

I tested version 1.15, the current software revision, which is menu-driven with single-character commands. It supports the Microsoft Mouse, but not Windows. A 486 with fast hard drive and VGA/EGA monitor provides best performance, but a compatible with 512K memory, CGA graphics, and a floppy drive will do.

I tried to enter the frequency to be displayed in the fingerprint disk file, but the entry was not accepted. AA7Y says this is a software bug that will be fixed in the next revision. That is why all the plots in this review show 00.0000 on the frequency line. The first signal I fingerprinted was a crystal-controlled repeater output (Figure 1). Most repeaters have continuously running oscillator stages, so there is no PLL hunting.

Immediately following the 200 millisecond sample period, the program displays the fingerprint on the left side of the screen, along with the detected CTCSS frequency, if any, and the signal amplitude, if receiver AGC input is provided. From that point until the transmission ends, it decodes and displays any DTMF digits received and determines the maximum deviation of voice and DTMF modulation. The display also includes the date and exact time of transmission start and stop.

A new fingerprint is produced each time a transmission begins. Of course, prints of repeater users must be made on the input frequency, as fingerprint data does not pass through the repeater. If you accidentally set the receiver to the output frequency, you will see the print of the repeater transmitter, not the user.

With the MOVE command, you can put the fingerprint of your choice on the right side of the screen for comparison with incoming prints on the left (Figure 2). The COMPARE command (not shown in the figure) overlays the print from the right side onto the print on the left, in different colors if you have a color monitor.

When COMPARE is commanded, the program automatically calculates a figure of merit for the difference in the two overlaid prints. "It subtracts the corresponding values of each supersample, with a maximum allowable difference value of 2 kHz each," says N7SNI. "The 64 difference values are each squared, then all are averaged."

Perfect correlation would give a mean-square difference of zero. That rarely happens, but most rigs have only small differences between transmissions, whereas prints of non-identical rigs usually show much higher difference numbers. The difference value is 4 for the two transmissions of Figure 1, and 9 for those of Figure 2.

By selecting the appropriate program mode, some or all fingerprints can be stored on disk. They can also be recorded on audio tape. Using a stereo tape deck, you can simultaneously log user fingerprints and audio on the left and right channels. The manual says the program will turn on your recorder at the start of a transmission and delay the audio until it comes up to speed, but I did not test this feature.

I spent much time using the ANALYZE feature, which allows comparison of fingerprints stored in one or more disk files. You can also put an annotation line on the prints and edit them down into a master file. The MOVE and COMPARE functions work perfectly with disk-stored prints, but there are minor program bugs in storing and display of the DTMF and deviation data.

The Acid Test

So how did TxID-1 do with different rigs of the same model? Very well! Most times, the differences were obvious, as shown in Figure 3. The mean-

square numeric value in the COMPARE mode for these two prints is 179.

TH-78s and other Kenwood rigs settle on frequency much faster than other brands, so they were harder to tell apart. But it was still possible to find differences, usually in the final frequency after PLL settling. (Of course, this value might be affected by such factors as temperature fluctuations in the transmitter and/or receiver, so care must be used.)

For fast-settling rigs, it would be desirable to eliminate the 2 millisecond delay between squelch activation and start of the print. Phil says he is working on a firmware upgrade that will store data to allow "looking back" before the squelch opens, to the exact start of transmissions.

A few HTs had wild variations in consecutive-transmission fingerprints, which turned out to be caused by near-dead batteries. Features such as a rig's battery saver also cause changes in its fingerprint (Figure 4). Then there was one rig at the meeting that seemed to have an unlimited number of prints that were similar, but with definite differences. I compared 10 prints from this rig and found only 7 out of the 45 possible comparisons had mean-square difference numbers less than 100. To avoid giving aid and comfort to potential troublemakers, I will not reveal the make and model. Fortunately, other rigs of this type at the meeting did not have these variations.

Parting Shots

Learning to use the TxID-1 is fairly easy and intuitive, but I can only give the manual a grade of C. It has plenty of detail to help you connect to receivers and recording gear. There are advanced topics such as command-line parameters and script files. But information on how to analyze and compare your prints is hard to find. For instance, there is no help in interpreting the mean-square difference function in the COMPARE mode and no explanation why the CTCSS frequency readout often gives false indications.

Motron's telephone support was very good, and I was able to get some added information on the program by reading the large (50K) help file on the program disk. Don Moser of Motron says a new manual is coming, along with Revision 2 of the software. It will fix all the known bugs. Also in the works is a remote access feature. You will be able to put TxID-1 on the receiver at your mountaintop repeater and downlink fingerprints via phone or packet radio.

I would like to see some other improvements in the software, such as a hard copy printout function. For the figures in this article, I used the computer's "PRINT SCREEN" key with a dot matrix printer after running the "GRAPHICS" command from DOS. There should also be an faster and easier way to start and stop the fingerprinting function without exiting to the MONITOR menu.

It would also be great if TxID-1 could be programmed to automatically search your database of known user transmitters and select the closest print or prints in it when your repeater is keyed up. This would be a faster way to identify "kerchunkers." Also, how about a way to automatically alert the operator when a particular rig comes on the air? This would be especially valuable when someone's transceiver is stolen. Don, Phil, and George say they are working on such features.

At $699 plus $8 shipping for the complete TxID-1 hardware and software package plus the cost of the computer and receiver, the Motron fingerprint system won't find its way into the average ham shack. However, it is well within the budget of many repeater clubs and is certainly a worthwhile addition to the arsenal of repeater councils and interference committees.

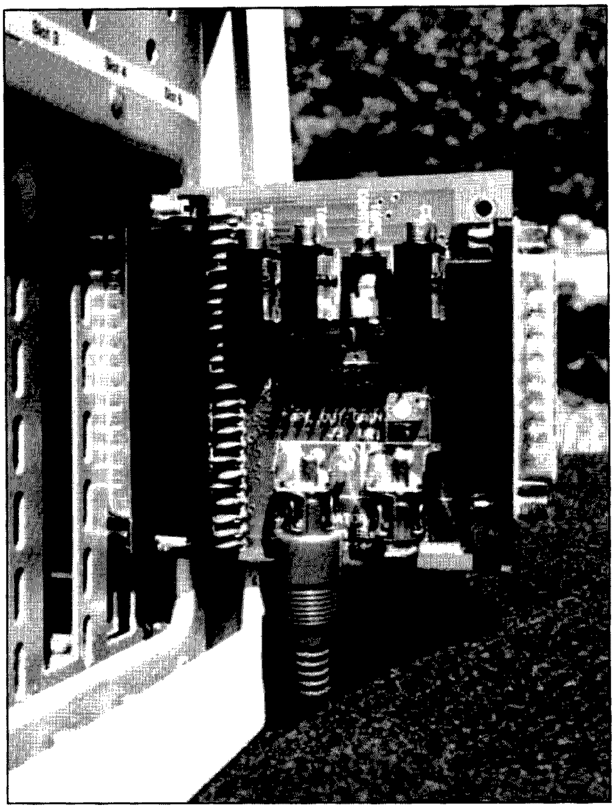

Photo B. The IA-1 Interface Adapter board has jacks for receiver discriminator and S-meter input, plus tape recorder on/off and audio. It attaches to the TxID-1 Transmitter Identifier board mounted inside the computer. The unused DB25 connector is for optional RS-232 control of AR-3000 receivers.

From its introduction, TxID-1 has had steady sales to government, amateur, and commercial purchasers. But according to AA7Y, many customers don't want the fact that they own TxID-1 to be public knowledge. "Nonsense!" says K7PF. "A system like fingerprinting does no good unless people know about it. A ham from Victoria, British Columbia tells me that the TxID-1 is like having a shotgun by the door. It never needs to be used, but everybody knows its there just in case."

TxID-1 is not sold at ham stores. It is available only from Motron Electronics, 310 Garfield Street, Suite 4, PO Box 2748, Eugene OR 97402, (503) 687-2118.

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The Hog Fence Antenna

Two months ago I wrote about the Hawg Amp. It turns out that members of the Big Shanty Repeater Group in Atlanta, Georgia, have an antenna project that makes the perfect companion for the Hawg Amp. Designed by Kip Turner W4KIP (based on an old *ARRL Handbook* design called the parabolic plane) and modified by David Rice KD4SHH, this antenna is easy to build and is a great performer. They call it the Hog Fence Antenna (also known locally as the Hawg Fence) for the basic building material that forms the reflector. Depending on your location, hog fencing is usually available from most hardware or farm supply stores and is very inexpensive. The hobby tubing and brass stock for the driven element can be found at hobby, craft or hardware stores.

This Big Shanty Repeater Group has been actively distributing plans for this antenna (as well as a description of their ATV repeater) to area hams to help encourage interest in ATV around the greater Atlanta region. The response has been very encouraging as many local hams have built the Hog Fence and found it a quick and effective way to view the activity on the BSRG ATV machine.

Once you've rounded up a roll of hog fence and the necessary brass parts (see the Parts List), you're ready to start assembly of the antenna.

Driven Element

Cut a piece of 1/32"-thick brass plate to a dimension of 1" by 2.5". Drill two 1/8" holes in the center of the plate exactly 3/16" apart (see Figure 1 for driven element details). The 3/16" spacing is critical for proper spacing of the tuning stub. Make sure that the spacing is exactly 3/16" edge to edge.

Next, bend the 1/8" x 36" brass welding rod in the center. Bend the rod into a "U" shape while maintaining the proper 3/16" gap between the two 7.5" sections of the rod.

Before making the last two bends on the welding rod, slip the rod through the two holes in the brass plate. *Do not* solder it yet, just make sure it has a tight fit to facilitate future adjustments.

Now bend each end of the welding rod so that the "U"-shaped section is 7.5" long and the vertical sections are 6" long each.

Cut two 12" lengths of 5/32"-diameter brass tubing and slip them over the ends of the welding rods.

Feedline Assembly

Strip the end of the 3-foot length of Teflon coax cable as shown in Figure 2. Solder the center conductor to the upper section of the U-shaped rod and solder the braided shield to the lower section. Be careful not to melt the insulation on or inside the cable. Secure the cable to the lower section of the U-shaped rod with a black nylon wire tie (use the black wire ties for UV resistance). Now install your coax connector on the other end of the cable.

Final Assembly

Solder or braze the brass plate (and driven element) to the section of the Hog Fence as shown in Figure 3. Be careful not to damage the coaxial cable by allowing it to be heated excessively. Note that the openings in the fence are to be positioned with the narrow direction running vertically (i.e. in line with the driven element).

Use plenty of black nylon wire ties to attach the two 36" pieces of copper tubing to the rear of the fence. Bend the fence into the described parabolic

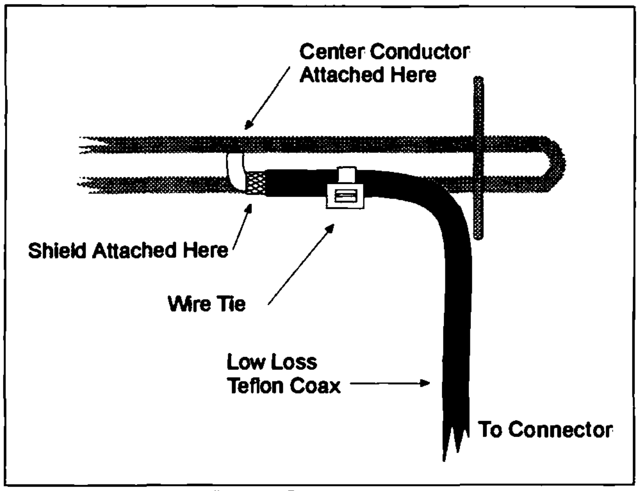

Figure 2. Feedline assembly.

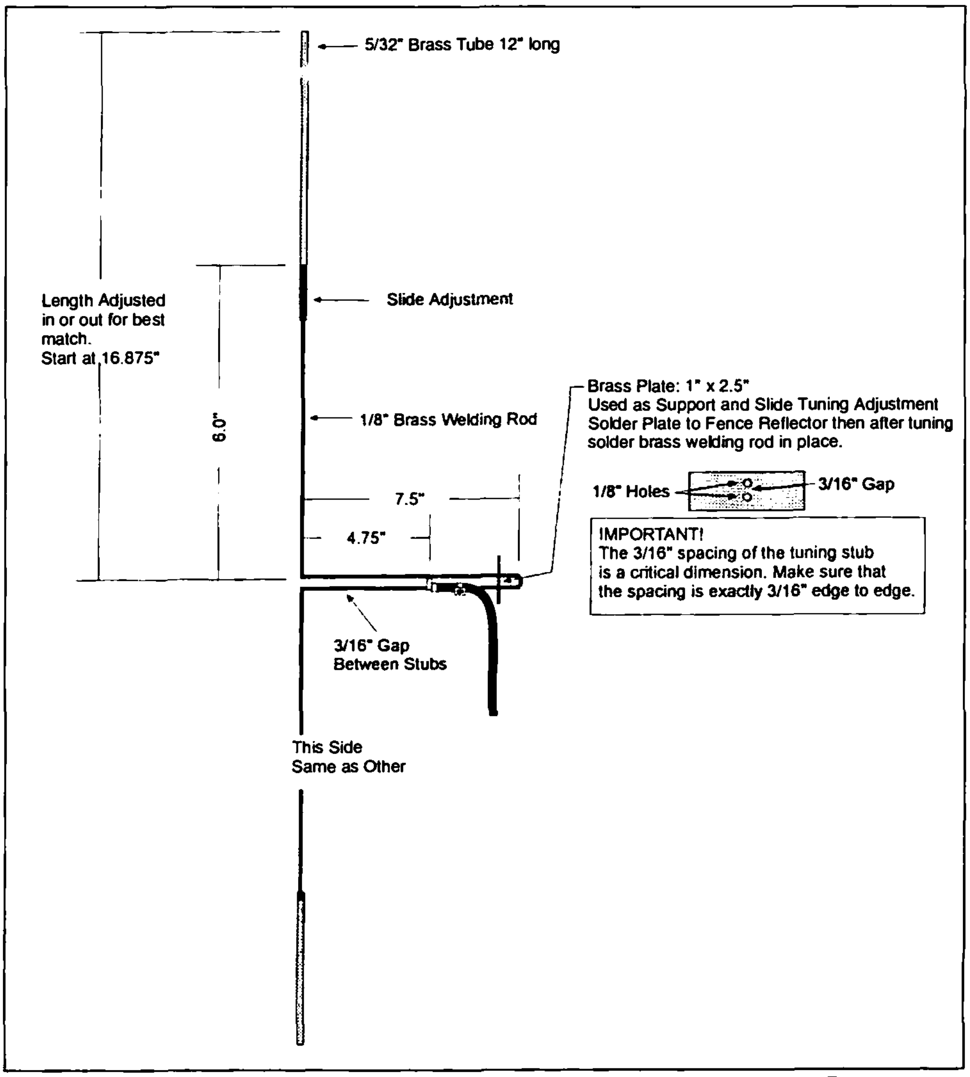

Figure 1. Construction details of the Hog Fence antenna's driven element, mounting plate and tuning stub. The brass support plate is first soldered to the fence reflector. Solder the brass welding rod to the brass plate only after final tuning is complete.

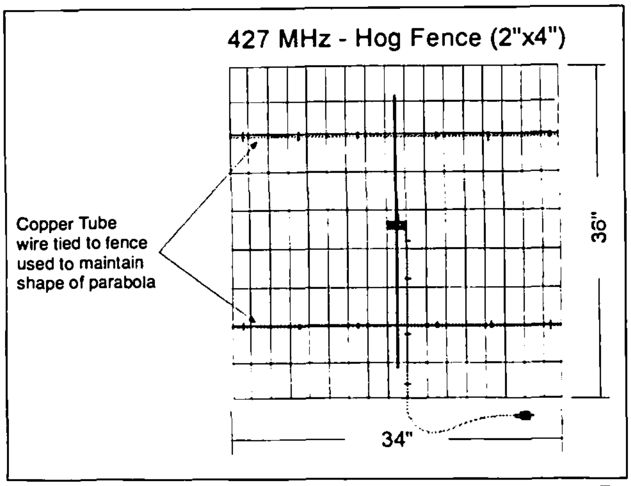

Figure 3. Final assembly of component parts of the Hog Fence antenna. The copper tubing is wire tied to the hog fence reflector to maintain parabolic shape.

shape using the measurements shown in Figure 4.

Go Hog Wild!

If your antenna is correctly assembled, it should be fairly close to being properly tuned already. The best way to tune an antenna is to transmit through it and adjust it for minimum reflected power. This is not really critical here unless you plan on using it for transmitting.

To tune the antenna, slide the two 5/32" pieces of brass tubing on the ends of the U-bent rod to the suggested lengths (see Figure 1). Now slide the entire element into and out of the brass plate. Use these three adjustments to optimize performance. Once the antenna has been tuned, solder everything into place and re-check the parabolic shape and SWR.

Install the antenna as high as possible (above the tree tops if possible), use the best low-loss coax you can find and have fun watching the ATV action.

The BSRG invites you to tune into their ATV repeater if you're in the greater Atlanta area. Watch for them on 427.25 MHz (easily received on cable-ready channel 58). They hold a net every Thursday night at 9 p.m. using the 146.655 (-600) repeater or the 147.345 (+600) repeater for the talk frequency and invite all to join in and watch the fun.

Thanks to Ralph Fowler N4NEQ, David Rice KD4SHH and Kip Turner W4KIP for the above information.

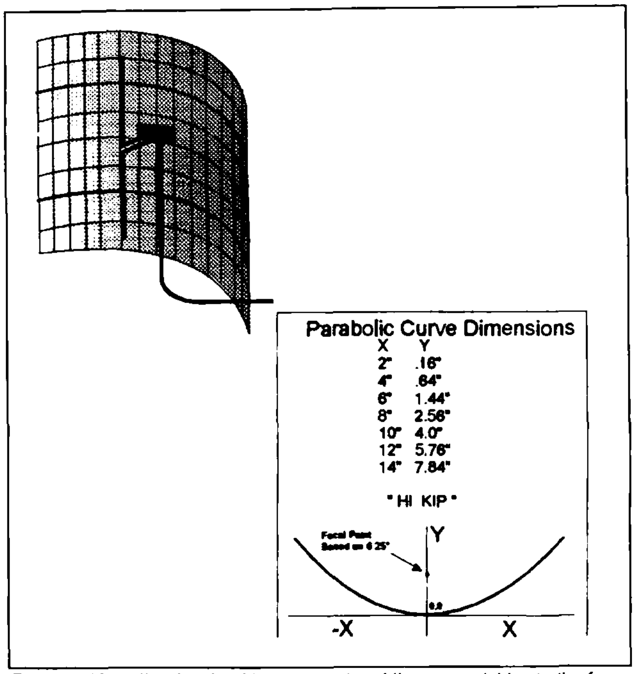

Figure 4. After attaching the driven element and the copper tubing to the fence, bend the reflector into a parabolic shape using these parabolic curve dimensions.

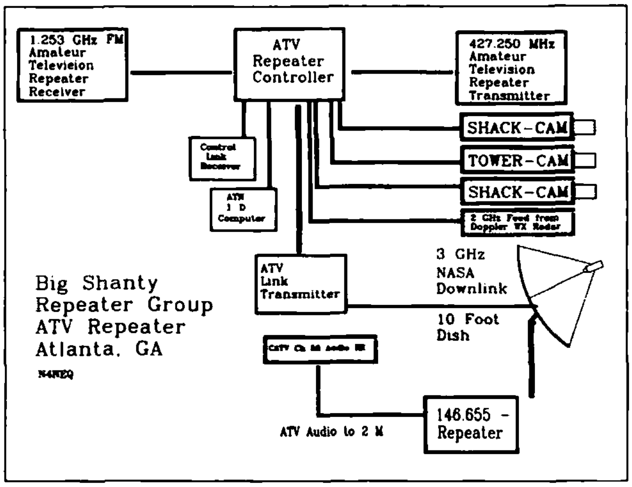

Figure 5. Block diagram of the BSRG's ATV Repeater.

Parts List

Qty.	Item
1	Brass Welding Rod, 1/8" dia. x 36"
2	Brass Tubing, 5/32" dia. x 12"
1	Brass Plate, 1" x 2.5" x 1/32" thick
1	Coax, Teflon or low-loss, 3-foot long
1	Coax connector (your choice)
1	Hog Fence (2x4 pattern), 34" x 36"
2	Copper Tubing, 3/8" dia. x 36"
20	Black nylon wire ties

Number 21 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

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Crystal Oscillators and Frequency Standards

Building on last month's column covering frequency measuring equipment, I want to cover crystal oscillators, especially the frequency-standard type of oscillators. In equipment today, ranging from the very basic VFO-controlled HF transceivers to the more sophisticated transceivers on the market, all are controlled by some form of crystal oscillator, if only a 100 kHz calibrator in the most modest of rigs.

The heart of any system rests in its ability to determine frequency, or at least allow the operator of the system a means of knowing where you are in respect to frequency. After all, if you don't know where you are, how can you make easy contacts with others? Some very simple QRP rigs can operate without a sophisticated receiver dial mechanism, but they do have the provision for setting frequency approximately by "NETTING" the transmitter frequency to the receiver. In these very simple and compact systems, the transmitter is crystal-controlled and probably shirt-pocket-sized, with very few frills incorporated.

The heart of the entire system is a CW transmitter that is crystal-controlled at the operating frequency. For stable design, the crystal oscillator needs some basics to ensure good clean operation, including voltage regulation of the battery supply voltage, usually 12 volts. It's a good idea to regulate down to a much lower voltage to ensure good headroom for the voltage regulator. This allows the battery to run down but still have the voltage regulator functioning at this lower voltage. The oscillator does not see any voltage change. Usually 7 to 10 volts is chosen for the oscillator-regulated supply voltage.

Other considerations include using a circuit for the crystal oscillator that does not try to run a high crystal current and draw maximum power out of the circuit. High current in the oscillator circuit is counterproductive, and just heats things up, making for unstable circuitry and possibly a fractured crystal. It is better to run crystal oscillators at very low power and current draw, with loose coupling. This allows the following circuits to do the work once the oscillator is doing its job. The oscillator stability improves when other stages do the heavy work, amplification and isolation. Usually these stages are called buffer amplifiers.

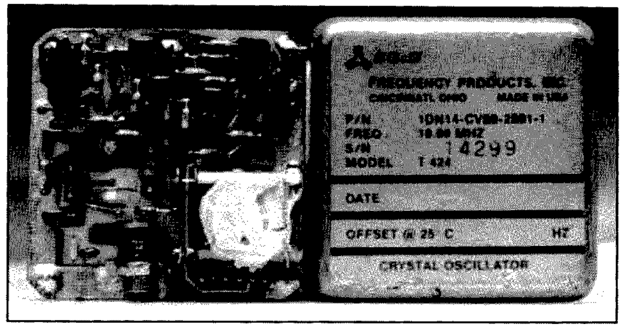


Photo A. TCXO oscillator: 10 MHz, temperature controlled.

Let's take an example from an HF transceiver and see what kind of stability is required for good operation and how it applies to crystal oscillators. In this example I will use a worse-case scenario at maximum frequencies. Let's assume our rig is operating at 30 MHz and the main oscillator is a synthesizer deriving its main clock from an onboard crystal oscillator. This onboard oscillator could be at almost any frequency from 1 MHz to 5 or 10 MHz, or even at an odd frequency such as 3.579545 MHz (TV chroma crystal).

In any case, let's assume the basic stability of the crystal to be 1 Part Per Million (1 PPM). In the 30 MHz transceiver described above, that would make the system frequency error at 30 MHz about 30 Hz—not bad for an HF rig. Even if the error were in the 300 Hz range it would fall in the SSB passband of operation and would not be noticeable.

I checked several HF rigs that were manufactured in the last 10 years and found a frequency disparity between the digital frequency display dial and the actual frequency, an average error of 400 Hz between the three rigs tested. This certainly proves that for 30 MHz or lower operation, a semi-modern rig is quite accurate for HF operations, and that is without any calibration since the rigs were new some 10 years ago.

Now you can see we have added another stability factor: crystal aging. As time goes on, all crystals need to be reset as even the most ultra-stable crystals and exotic circuitry do indeed drift

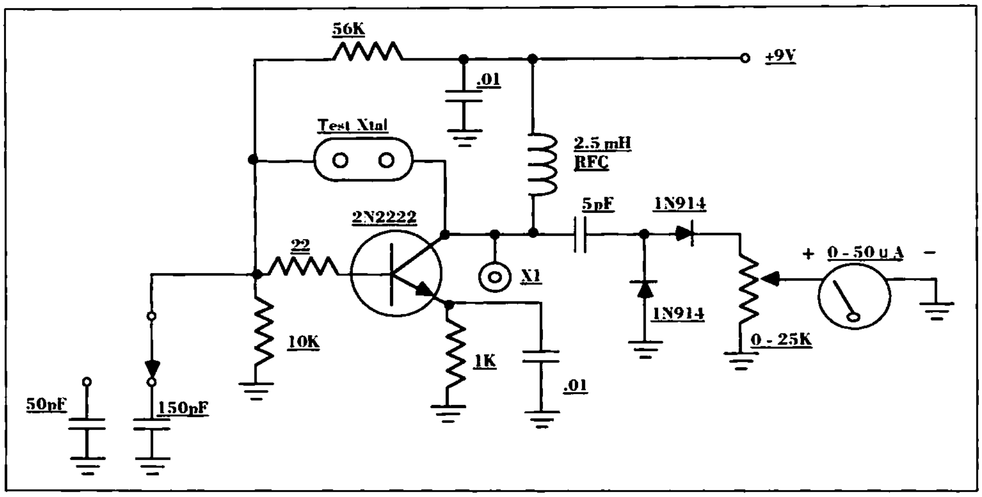


Figure 1. Sample crystal test oscillator. Diodes: 1N4148 or 1N914; RFC: not critical value; X1: connector for 6" antenna wire, providing RF to the receiver for testing/monitoring.

due to aging. This might not seem much at the present level of discussion but it does happen. New crystals seem to age (change frequency) faster than older (burnt-in) crystals. The change is quite small in comparison to the 1 PPM we have been talking about, and in most cases need not concern you at all in the context of the HF scenario above. Basically, look at aging as a point of interest in very high-stability oscillators/standards. Note that periodic calibration is required in all applications to maintain very accurate conditions.

Let's go back to the HF system error scenario, assuming a 400 Hz offset from indicated frequency (I call that excellent for HF operation). So what's all the excitement about being off frequency? Well, when this kind of error is measured at higher frequencies it can become out-of-hand in short order. If we transfer the same error, 400 Hz at 30 MHz, to 148 MHz, it becomes almost 2.5 kHz. That's one-half the FM bandwidth for standard operations, and begins to become a gross error. If the same factors are applied to 450 MHz or even 1.2 GHz the error starts to become quite unmanageable. We know that these errors are not present in our modern systems at 450 or even at 1296 MHz. How is that accomplished? Well, these systems use a tighter frequency standard (clock) for the PLL synthesizer internal to the system and systems that do not use frequency multiplication, which increases error.

These tighter frequency controls are present on almost all of the modern-day synthesized systems for almost any frequency today. Now, how does this compare to home-built oscillators using surplus crystals, or test evaluations of older commercial oscillators purchased on the surplus market? Let's use price as a beginning equalizer and see where that leads us. Aside from individual quartz crystals, either surplus or new, installed into home-constructed oscillators, the output frequency can vary quite a bit. How much depends on the circuitry of the oscillator and how it interfaces with a crystal and its series and parallel parameters and load capacitance.

If the crystal is surplus, not much is known about its particular characteristics (as described above). Construction with these components can be fun but will need tweaking, and possibly a different type of circuit to make the crystal operate on the exact marked frequency. In other words, plugging a crystal into a standard oscillator will make it oscillate but not at its specific frequency. For that

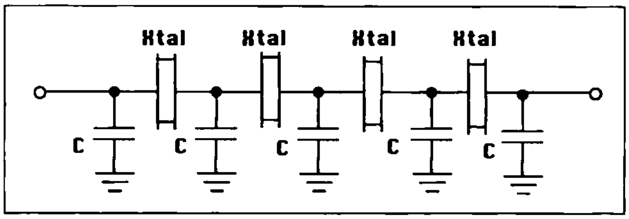


Figure 2. Crystal ladder filter, constructed from four matching crystals. Capacitor values are approximately 15 to 30 pF.

to take place, both the crystal and the circuit have to be in concert with each other. See Figure 1 for a standard-type test oscillator to evaluate a crystal's functioning.

Crystal-matching for a filter application is done with a signal generator and a special piece of equipment called a vector voltmeter. This vector VM notes phase changes in respect to frequency, which is varied for this test. In this way you can match the exact characteristic of the series and parallel resonances of each crystal under test.

A simpler test setup is to use the simple oscillator shown in Figure 1 and listen on a receiver where the crystal oscillates and without readjusting anything but the receiver. Test other crystals of the same marked frequency. When you find a bunch of these, some measure of assurance is a given that these crystals are of nearly identical frequency. Use the receiver frequency for this match test of the tested crystals. Put the crystals in a row according to receiver frequency. When you have a bunch of crystals of the same characteristics, use them for the filter. The other crystals are good, but not matched. Try this test and you will see the frequencies of the crystals vary quite a bit. See Figure 2 for a typical crystal ladder filter.

Other types of oscillators include "PUT UP," as I call them, or complete oscillators and crystal assemblies. These units comprise a complete oscillator, including the crystal, and are assembled into a package. The simplest and most inexpensive is the TTL IC-chip-socked oscillator. This device has no external calibration, is powered by +5 volts, and can be inserted into a 14-pin IC socket for use. They cost less than $5 each new and I have found them in surplus, removed from PC boards, for about 25 cents each. Specific frequency of these is almost endless, especially in surplus. Mouser Electronics lists these oscillators from 1 MHz to 64 MHz, with about 25 stock frequencies. The stated accuracy is +/-50 PPM, or 1 kHz at 10 MHz. That's not too bad, considering that new it costs less than $5. A 30 MHz oscillator connected into a 10 GHz detector mount makes a "BOOMERANG" for testing a 10 GHz wideband FM system. See Figure 3 for the BOOMERANG construction details.

The next oscillator models that have become available through surplus take a big jump in accuracy. They differ in several ways from the free-running non-adjustable TTL type unit just described. Most of these units are designed around two different circuit concepts for stabilized operation. Both methods incorporate lightly-loaded multi-stage circuits with tight voltage regulation to minimize external effects on oscillator stability. This type of circuit has adjustment capability to trim to an exact frequency by external means. Most are mechanical screwdriver adjustments, but some can have external voltage/varactor type control.

These two types of oscillators differ in how control is applied to the entire unit to maintain a high state of accuracy. The first type uses an oven-type heater to heat the entire crystal and oscillator circuit to a fixed regulated specific temperature. This temperature is far above ambient room temperature and is usually somewhere near 125 to 140 degrees F. The crystal and its associated components are selected for operation at this fixed temperature. This circuit is referred to as an "Oven-Controlled Crystal Oscillator," or OCXO. As such, the oven circuitry requires a lot of current to warm the entire unit, bringing it to proper operational temperature.

Fast warm-up oscillators' current could be 24 volts at 1 amp before the thermostat kicks in and throttles the current back to, say, 1/2 amp or so. An oven circuit can be a power transistor with lots of current to generate heat, coupled to a heat sink (the oscillator compartment), or resistance wire-wound over the oscillator's inner case. Both produce heat to the OCXO circuit. High-quality OCXOs can cost from $300 to $1,150 for 0.1 PPM or better oscillators. Prices vary, with costs about 10% of new for surplus oscillators. See Photo B for a sample OCXO.

Where to find high-accuracy OCXOs? Well, almost all surplus military test equipment uses a very high-quality oven-controlled oscillator as the main system clock. Sure, they do draw a lot of power from the supply, but when you are plugged into 110 mains it is just another trade-off in circuit design. The designs vary quite a bit. I have opened up about 20 different models from about half as many manufacturers, and the circuits vary wildly. Some of the very expensive types utilize several ovens for premium temperature stability. The idea here is to have a very slow warm-up

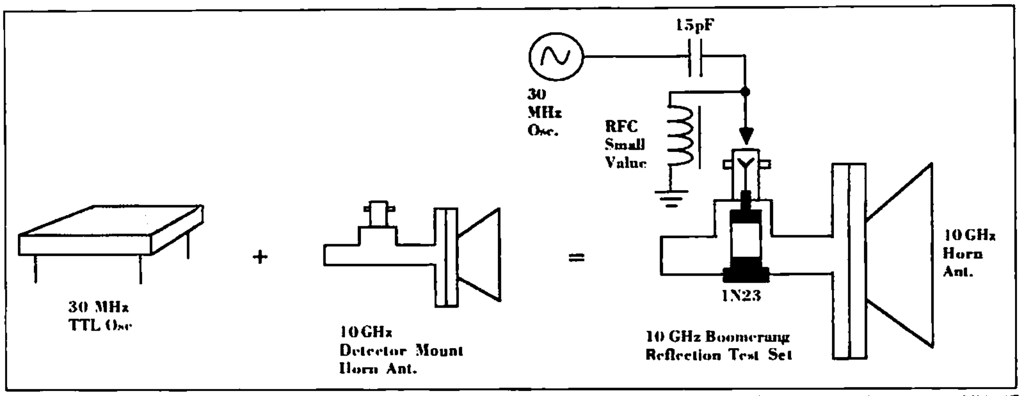


Figure 3. 10 GHz BOOMERANG using a 30 MHz oscillator. A 10 GHz BOOMERANG test set for use with wideband 30 MHz IF systems, providing enough signal to a transmitting 10 GHz system.

cycling oven controlling the internal oscillator circuit. This entire circuit oven and oscillator is then insulated from temperature changes with a styrofoam package and this is contained within another oven-controlled circuit The result is a more precisioned heat cycle with the oven-within-an-oven concept.

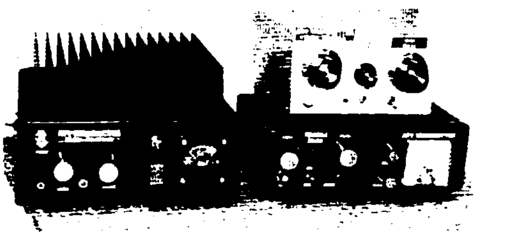
The principle of the dual ovens is like the dual-door system that you find in the snow belt. The main door to the outside opens to a second door which is the main door for entry into the building or home. The idea here is that the main door does not open to the cold outside, but to a second door, minimizing heat loss in the winter months. The dual oven works on much the same principle: one heat coil to assist the other coil, for minimum temperature change.

TCXO Oscillators

A TCXO differs in circuit operation from an OCXO in that it does not have any oven-type control circuitry. How it controls the crystal vs. temperature is different. The TCXO circuitry uses variable components in connection with thermistors to make circuit adjustment as temperature varies. The process is much like a VFO and varactor capacitor circuit. As the VFO now is varied, so is its frequency. In the TCXO oscillator the thermistor is much like the VFO in this application. The varistor varies its resistance, following temperature to make appropriate control voltage changes to maintain frequency accuracy vs. temperature changes. It's more complex circuitry, but it has many benefits over an OCXO. They are small-sized, and operate at low current. The cost for a TCXO runs about $300 new; in surplus, something under $50. For those interested: I have a purchased a limited quantity of these oscillators and will make them available; see the end of this article for details.

The low current consumption of a TCXO can run around 50 mA. Circuits are temperature-rated over a large temperature range, usually over 100 degrees or more, depending on the quality of the oscillator. The oscillator shown in Photo A is the TCXO that I use in my portable 10 GHz station. Its accuracy over a large temperature variation is 1 PPM. Over a much narrower range of temperature (70 to 90 degrees F) or so, it is capable of much better stability, somewhat better than 0.1 PPM for short-term stability. Photo A shows a defective oscillator assembly removed from its case. It's placed next to a complete unit. The TCXO is 2" square and 1/2" high. The defective oscillator shown had a shattered crystal, probably from rough handling. I eventually put it to use as part of a crystal test oscillator.

The stock TCXO uses three transistors, one voltage regulator, three thermistors, and one Johanson variable frequency-setting capacitor. The thermistors are thermally bonded to the crystal for maximum sensitivity to the crystal's temperature changes. The Johanson variable capacitor is quite expensive (about $13 single quantity), and as such is a very accurate capacitor. It is



part of the consideration and accuracy of this type of oscillator.

With regard to both the TXCO and the OCXOs just described, most units available are small compared to a soda-pop can. By comparison, an OCXO would be about half a can, and the TCXO would be 1/8th of a can in size. Moving into the arena of the next higher accuracy standard makes size comparison pale by contrast to a soda can. Frequency standards of higher accuracy can be small but are "UNOBTAINUM" on the surplus markets. What do show up are the Frequency Electronics Incorporated (F.E.I.), Seltzer, and a few other types. Most are relay-rack mounted for 19" bays, and weigh in at about 15 to 20 pounds. The F.E.I. standard weight is 20 pounds, and has a small package profile 8" high, 4" wide, and 18" long.

The package is a self-contained oscillator with multiple oven control for the crystal oscillator. It has an on-board transformer-isolated regulated power supply, and a secondary power DC battery emergency operation. The emergency battery power is 24 volts at 2-1/2 amp capacity. The front panel has provisions for monitoring status of all the individual ovens and battery voltages in addition to oscillator output at various frequencies such as 100 kHz, 1 and 5 MHz. The part I was holding out on is that the accuracy of this "OVEN CONTROLLED BEHEMOTH" is 1 millihertz at 5 MHz. That equates to 0.0002 PPM, or a few parts in 10 to the 10th decimal place. Provision for calibration maintenance is provided by a 10-turn counter dial to adjust for portions of 10 to the 10th part adjustment for very accurate calibration.

For short-term stability it can be adjusted a little tighter in accuracy, but to accomplish this I would have to phase-track over a much longer time period, days instead of 10 to 12 hours. The effort involved and the benefits derived did not seem worth it at this time. I am not trying to go into rocket science or predict what will be an exact frequency with minimum error; gold-plating in this case is better left to the back of a watch than my frequency counter.

The battery operation in these standards is nice, especially when the AC power is removed. The batteries take over if there is nothing happening and operation continues for about six hours or so. A nice feature is the ability to use the batteries in a planned operation to assist in the calibration of other amateurs' frequency counters or standards. To do so, just unplug the standard (battery operation starts) and drive over to the other amateurs' locations. When you get there, re-plug into AC power to charge the batteries and take your time to recalibrate at this new location. As far as the F.E.I. standard is concerned, it never left AC power—as long as the batteries last, accuracy is maintained.

I tested this several times to see how well our "Traveling Clock" would hold accuracy with battery operation, and was pleased to see that there was no change at all. Even when we experienced some harsh movement of the case, it tipped over in my station wagon on a trip to the grocery store. On the second trip it was treated a lot better—it got to ride on the rear seats with a seat belt holding it down. I only have one of these jewels and don't want to try the "DROP TEST" at this time.

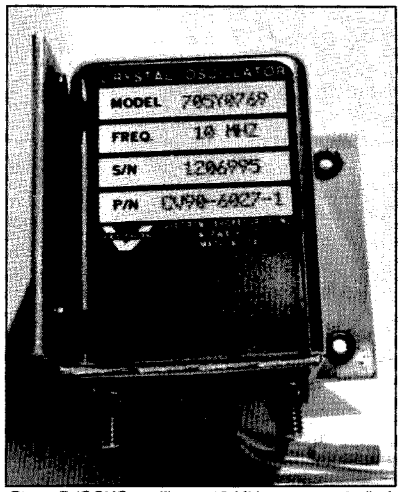


Photo B. OCXO oscillator: 10 MHz, oven controlled.

Well, I hope this gives you some idea of what to expect in the line of frequency calibration and what type of accuracies to expect from your frequency counters and various oscillators you might happen to find in the surplus market.

To obtain surplus standard oscillators, check out used broken frequency counters. A surplus military counter with a functioning high accuracy standard, even though "crunched," should allow you to at least remove the standard and discard the rest. Keep your eyes open, and good hunting.

As always, I will be glad to answer questions concerning this and other aspects of our hobby. For a prompt reply please send an SASE. Concerning the TXCO 10 MHz oscillators, I have a limited quantity available for $40 each plus $3 shipping (U.S.). I do run into a few higher accuracy types from time to time and will source them for you. Call for details. To order a TCXO oscillator send requests to Chuck Houghton, 6345 Badger Lake Ave., San Diego CA 92119. Well that's it for this month. Next month we'll get into simple microwave test equipment that can be home constructed. 73's Chuck WB6IGP.

Number 22 on your Feedback card

ASK KABOOM

Your Tech Answer Man

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The Shack Brain

If your ham station consists of more than an HT, you know that computers have become important in this hobby. Heck, even if your station *is* an HT, you may be using a computer for packet operations. There's just no getting around it: Computers are moving ever closer to being the centerpieces of our stations. Some hams complain about that idea, valiantly resisting the notion that it isn't just about radio anymore. Others, though, are having a blast with the new technology and making hamming more interesting than it ever was before.

Of course, it's still about radio! These days, though, that doesn't mean just yacking on 20 meter SSB or 75 meter AM. Now we have SSTV, packet, RTTY, AMTOR, PACTOR, automated CW, satellite, and who knows what new modes soon to come. For all of this stuff, a computer is either helpful or essential. Let's take a look at how to integrate a computer into your shack.

Ham on a Budget

Sometimes I think that's what I should call this column! Thanks to my own lean financial situation (I'm a musician—need I say more?), my focus very often is on how to do the most with the least cash outlay. And yes, that's what I'm aiming at here: You can put a computer in your shack without breaking your bank account.

Eenie, Meenie . . .

But what to pick? Do you really need the latest 486 or PowerMac monster boxes? That depends. If you want to run Windows, you really need at least a 386, and a 486 is a very good idea. But is that essential? Not really. You can run piles of great software without Windows. Then you won't need four megs of RAM and a real fast machine. Suddenly, all those computers and motherboards at the hamfests start looking quite interesting!

If you've been to one in the last five years, you must have noticed that computer gear is at least as visible as radio gear, and often more so. It seems like you just can't get away from it! Aisle after aisle, you see hard drives, interface cards, monitors, printers and even complete computers. Far and away, the IBM-compatible hardware rules the roost. Oh sure, you'll see some Commodore 64s, Apple IIs, and even some old, unrecognizable stuff. Not that many years ago, the Commodore was *the* machine to ham with, but today the IBM format dwarfs them all by quite a bit. Not only is most of the cheap hardware of that type, but most of the newer ham software is for the IBM PC, too. So, Mac lover that I am, I really must recommend that you go with an IBM-compatible for hamming, especially if you want to do it on the cheap. There is a substantial amount of Mac ham software, but bargain hardware is still hard to come by, unless you want a really tiny, old machine that won't run too many of today's programs. And you're not likely to get a hard drive. The reason is simple: The clone market has created lots of castoffs of slightly outdated IBM-type machines, while the Mac market, wholly owned by Apple, has updated much more slowly. The only Macs I ever see at hamfests are the old 128Ks and 512Ks with single-sided floppy disk drives, and there just isn't that much you can do with them.

So, we're back to the issue of what kind to get. If you have plenty of money, go with the biggest, best machine you can. But remember, this is the "ham on a budget" column, so I'm going to describe how I did it, all for well under $100.

What's a 286??

As I mentioned, if you're not going to run Windows, you don't need a huge machine. I picked up a 286 with a 20-meg drive and a color VGA monitor, all for $40. At the time, I thought it was an extraordinary deal, even though the machine didn't work. Since then, however, I've seen a bigger one, with a 40-meg drive, more RAM, etc., for the asking price of $100. So, perhaps that's what 286s are going for these days. If so, they're quite a bargain.

What can you do with a 286? Just about anything non-Windows you can do with a 386 or even a 486, only a little bit slower. But before I go into the computer's application, let me describe what it took to make it run, so you'll get an idea of what you might come up against, should you decide to go this route.

The computer basically worked, but it would randomly crash and lock up. After checking the obvious things like connectors, I noticed that three ROM ICs on the motherboard were in sockets. Having run into bad connections with sockets on my old Apple IIs, I pulled the chips and cleaned the pins. And it worked; no more crashes. The hard drive worked fine, although I think

I just got lucky on that; old hard drives generally are to be viewed with suspicion. Other than a blown fuse in the power supply, which used the switched AC socket for the monitor, the computer had no other problems. But, if it had, I wasn't too worried because, at the last hamfest, I'd seen piles of functional 286 motherboards going for $5 each! 386s were under $50, and there were even some 486s around $100.

The monitor was another story. The seller told me he'd replaced the horizontal output transistor a few weeks earlier, but the set had died again. When I opened it up, sure enough, the problem was a blown horizontal output. A new one, bought for $2.50 at the next hamfest, worked but ran awfully hot. When you can't touch the heat sink, you know a transistor is too hot. Hmmm, the characters at the right side of the screen were squished together a bit . . . the scan wasn't linear. A bit of probing and a little trial and error turned up a leaky electrolytic coupling cap at the base of the transistor. No wonder it was running so hot—its bias must have been way too high from the added DC coming from the previous stage. That would explain the distorted scan, too. A new cap from my junque box fixed it all up, making the transistor run at about 1/4 the temperature and unscrunching the scan.

Set 'Er Up

So, now I had a perfectly usable computer. What to do with it? Actually, it wasn't hard to decide that, because I'd bought the thing with hamming in mind. It went right into the shack, which is actually a shelf unit by my bed (I'm a lazy ham). OK, time to connect it all up. Here's how it came out:

Packet I use my HT as a base station, with a little switch box which gives me the choice of normal voice operation, with RX audio from an external speaker, or packet. For packet I use the software TNC called Poor Man's Packet, which came from an article in *73* a few years ago. The modem is home-brewed and built into a connector shell, plugged into the computer's parallel port. It doesn't get much simpler or cheaper than that.

RTTY A hamfest-procured MFJ-1224 RTTY/CW interface connects to a serial port. Their RTTY/CW software completes the picture. The RTTY works quite well, copying signals down to about S-1. The CW receive decoding is not great, but then I've never seen a computer do too well at that; the code was designed for human decoding and doesn't lend itself well to machine processing. Heck, I need to keep my copying skill up anyway, so I don't really mind. But for sending, it works fine. I'm not yet on AMTOR, but I have seen advertised a program which will do it on a simple interface like this one, without a multimode controller. One of these days I'll try it and let you know how it works.

SSTV Here's where a computer really shines. Right now, I'm using the Pasokon SSTV Explorer, which is a receive-only package that connects to my second serial port. Even with the comparatively primitive VGA card I got with the computer, it works great. It's a real blast watching the color pictures roll in on 14.230 and 14.233, and I'm hoping to get the full TX/RX system one of these days.

Rig control I'm not doing that yet, but I would like to set it up. It would be great to store lots of frequencies in memory, skip around the bands, have direct frequency entry, and get all the other neat things available with computer control of the transceiver. I need CAT software for my FT-747GX (or some other Yaesu radio, as long as the software is in BASIC so I can modify it for my rig). If anybody has any public-domain or shareware programs to do that, please let me know.

Logging I'm not a contester, but I may get into logging one of these days anyway. There are lots of programs around, and it sure does take the hassle out of keeping accurate records of contacts.

Atlas Any general-purpose atlas program can be quite useful and lots of fun. Talking to Botswana? Take a look at where it is, pull up some statistics about its people, and you have the making of a conversation much more interesting than the usual "5 by 9, next station please" QSO. That is, of course, if all those wallpaper-obsessed DXers will let you actually talk to the DX operator.

Beam headings If you have a directional antenna, a beam-heading program will let you know where to swing the aluminum. As a dipole op, I don't need this. Ahhh, someday, perhaps.

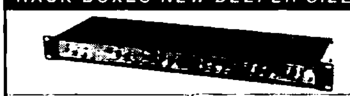
Satellite Not my bag (yet), but computers are pretty essential for satellite work. The tracking programs tell you where and when to aim your antenna, and some hams even make the computer do the aiming for them, keeping the bird down the boresight as it moves across the sky.

Math and electronics If you home-brew, work with microwave gear, or do any other fairly technical stuff, a computer can be a tremendous help. There are shareware programs for antenna design, resonant circuit calculations, you name it.

All Together Now

As you can see, a computer in your shack can make a big difference. If you do go with a fast 386 or a 486, you probably can multitask, which means you can run several of these applications at the same time. For general computing, multitasking seems a bit silly to me. After all, we humans usually need to do just one thing at a time anyway. But, for hamming, multitasking can really be great. Imagine running your logging, rig control and SSTV programs at the same time, while monitoring and storing packet traffic in the background. That, however, is asking too much of a 286. Also, it requires wiring everything up so that there are no hardware conflicts, which is not presently the case in my system; if I tried to run, say, packet and the RTTY interface at the same time, they'd get in each other's way because the power for the packet modem comes from the same serial port which drives the RTTY box, and some of the lines are shared. Oh well, that's hamming on a budget!

Well, I hope you've enjoyed this deviation from our usual theory and troubleshooting topics. If you're already computing in the shack, consider trying some new modes and exploring more of the options your computer offers. If you haven't taken the digital plunge, I heartily recommend it. Oh yeah, before I forget . . . I picked up an old NEC PC-8201A laptop. Anybody got a book or any info on it? Thanks, I appreciate the help. Until next time, 73 de KB1UM.



73 INTERNATIONAL

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Notes from FN42

I am sorry to report that our Hambassador to the Canary Islands, Woodson Gannaway N5KVB/EA8, has left the Islands for four years of study in the United States. We will miss his wonderfully descriptive reports of the Canaries. Best wishes go out from us at 73 to Woodson and his family. Thank you for a job well done!

Congratulations to Phil Weaver VS6CT, Hambassador to Hong Kong, for his selection as president of the English Language Amateur Radio Communication Society. Good luck during your time in office. I know the Society is in good hands.

A special welcome back to Mahmoud Idera-Abdullah EL2CE, Hambassador to Liberia, after a long communications absence from 73. We're glad to have you back, Mahmoud!

There's much news from these Hambassadors, as well as other reports. Let's get to it.—73, Arnie N1BAC.

Roundup

Belgium/Egypt: *From the Support to The Amateur Radio Service (STARS) News:* Africa Telecom 1994: Abdi A41JT and his Omani friends, together with Ezzat SU1ER and his crew, made the STARS participation in Africa Telecom 1994 a great success. The ROARS delegation flew into Cairo with some 400 kg of "luggage," containing a complete HF and VHF amateur station, antennas, digital equipment, etc. Ministers of all the participating countries visited the IARU stand, some of them wrote some personal remarks on a QSL card. Also, His Excellency, President Hosni Mubarak, paid a visit to our booth. Thousands of leaflets were handed out to passers-by and Abdi also arranged for some suited T-shirts and caps for the operators.

The special event station SU1STAR operated daily from 0800 'til 1900 and made some 5,000 contacts in all modes. The visit of the MPTT staff of Egypt and several other African countries was considered a big success to the region. They were briefed clearly on amateur radio, and they promised in return that they would support the amateur service in their respective countries.

South Africa: *From the STARS News:* The South Africa Radio League (SARL) has secured the franchise to set and administer the Amateur Radio Examination. This will come into effect in November 1994. The HAREC syllabus has been accepted and will be used as the basis for the examination. The SARL will offer the examination to Lesotho, Swaziland, Botswana, Namibia, Zambia, and other African states where English is the official language. This will greatly reduce the cost that students have to pay for examination fees. The fee for the SARL examination is 40 Rand ($13).

Switzerland *From the International Telecommunication Union (ITU) Newsletter:* The ITU Council adopted unanimously a resolution authorizing the Government of National Unity of South Africa to resume its full participation in the conferences, meetings and activities of the Union with immediate effect. The Chairman of the Council, Mr. Souleymane Mbaye (Senegal), informed the entire membership of the Union.

CANARY ISLANDS SPAIN

Woodson Gannaway N5KVB/EA8
5402 Spicebush
Madison WI 53714
USA

HOLA, one last time from Echo Alpha Ocho land.

The crew at the Radio Club of Las Palmas is still on course and maintaining a good head of steam. I was able to visit them last week after a lapse of 9-10 months (just about the age of our little bundle of joy—funny how that works). Catching up on things, I found out that the only general ham radio store in the area had closed. Now the club was about ready to take up the slack by opening a "mini" store at the clubhouse on September 10. The event will be complimented by a flea market.

Pity I won't be able to make it as I'll be back in the States by then. This will be my last report from the islands I've grown to know and love so well; really more the people than the islands themselves. The scenery is spectacular and varied but the true value of any place is in its people. These people have given me a great deal!

But now it's time to study for four years and then go overseas again. Planning to return to the same place is usually unrealistic.

Often you don't realize what you've learned. I was on a visit back to the States and on my way to visit some friends when I came to a group of young men talking around some cars. There wasn't quite enough space to pass, so I stopped and waited. They noticed me and kept on talking. After a couple of minutes waiting I thought, I've been living and driving in Europe and no self-respecting CAnary would let this stop him. I can squeeze through there. And so, with a borrowed '75 Bonneville (it'll pass anything on the road except a gas station) and all, we drove through with maybe an inch to spare on either side. Instantly the young mens' nonchalance turned into appreciative whistles. They loved it!

Photo A. Mahmoud Idera-Abdullah EL2CE, 73 Hambassador to Liberia.

Our little girl is Canary, never mind that her parents both have U.S. passports. She was born here. We wanted to do that, to give her to Canaries. Now she'll always have a special place in the heart of any Canary Islander. And we'll continue to speak Spanish to her so that she will grow up bilingual. There are not many things in life that are actually important, but things like this are. And, of course, she'll go with me when I visit the Hispanic neighborhoods where we'll live. Her first visit to a blacksmith shop was when she was two weeks old. She slept peacefully through the hammering two feet from her in her Snugli carrier. A friend coined an appropriate term: "4-wheel-drive kid." I like that.

I've enjoyed my years as a correspondent for *73* magazine. I hope you readers have enjoyed them too. We'll see what's next.

73—Best wishes—Hasta siempre, Woodson N5KVB/EA8.

DOMINICAN REPUBLIC

Bill Meara N2CQR/HI8
Unit 5510
APO AA 34041
USA
Packet: N2CQR @ HI8WR.SD.DOM.CAR.NA

[Continued from October] One of the newest attractions of Santo Domingo is the beautiful Faro a Colon, or Columbus lighthouse. Completed in 1992 and inaugurated during the commemoration of the 500th Anniversary of Columbus's arrival, the memorial houses the remains of Christopher Columbus. The enormous cross-shaped building projects a powerful beam of light into the skies over Santo Domingo. When the clouds are configured right, the sign of the cross hovers over the city. It is very beautiful. While the project was completed in 1992, I was amazed to find (in our club house) HI8 QSL cards from the 1930s bearing images of the structure. Dominican hams of 60 years ago had seen the sketches for the planned memorial and had incorporated them into their QSL designs. I guess it's not surprising that hams would have been intrigued by a structure that sends a beam into the heavens!

Besides the above address and packet, I can also be reached on-line at INTERNET: 74537.1100@compuserve.com. 73 from HI8!

HONG KONG

Phil Weaver VS6CT
President E.L.A.R.C.S.
GPO Box 12727
Hong Kong
Packet: VS6CT @ VS6XMT.HKG.AS

Since the last report from Hong Kong, you will no doubt have started to hear the new prefix of VR2. This has become necessary with the changeover of the administration (not the government: that will still remain an independent body within H.K.) of Hong Kong from Britain to China which will take effect from 1 July 1997, and the need for a different callsign. The VS series is assigned to the British Commonwealth. The reason for this is that Hong Kong will remain as an independent territory, as a Special Autonomous Region (SAR), and as such will retain its separate "country" status from China. In the meantime, all new amateur station licenses issued since December 1992 by the Office of the Telecommunications Authority (OFTA) have been issued with the VR2 prefix. Existing holders of the VS6 prefix will be allowed to retain the use of either VS6 or VR2 until the final moment. Many of us, myself included, will continue to use the VS6 as we have a large investment in QSL cards already printed.

Another major change has been the introduction this year of an "Authority to Operate" (ATO). This is in addition to the station license (valid for one year), which is still being issued, and will in the future cover the station and its equipment whilst the ATO is issued, on production of a proper certificate of a pass in the appropriate examination or a reciprocal from another country, and is valid for five years. This means that a visitor to Hong Kong, in the future, who wishes to operate from Hong Kong using someone else's station can obtain an ATO on arrival from the

OFTA, and this will be valid for five years. If he is not going to become residential, the call assigned will be "VR2/home call." Upon production of a Hong Kong Identity card, he can claim a full VR@ . . . call for the class of license he is entitled to.

There are considerable advantages to the new system: It will mean that a visitor gets a five-year ATO instead of just one year, as previously, and he will not have to obtain a station license unless setting up his own station.

The English Language Amateur Radio Communications Society continues to thrive and our annual dinner this year will be held again at the Royal Hong Kong Yacht Club on Thursday, December 8. The cost will probably be about US$45, including all drinks and many door prizes. If you are planning to be in town around that time you would be very welcome to join the party, but do let me know in advance so that a seat can be reserved. If you have any queries concerning the above, drop me a packet or facsimile with your inquiry and I will endeavor to help. *[Tel: 852-887-6366; Fax: 852-887-6992]*

LIBERIA

Mahmoud Idera-Abdullah EL2CE
C/O UNDP, Liberia
P.O. Box 1608
New York NY 10163-1608

I am sorry that I have been unable to correspond with *73* since my acceptance as Hambassador to Liberia and the submission of my first contribution. Things really got hot around Monrovia, as civil war was spreading throughout the country.

After more than three-and-a-half years of fighting and total breakdown of the government and society, things are slowly getting back to normal. Here in Monrovia, life is quite improved and is gradually normalizing.

The last three months of 1992 were really rough! This turned out to be the most threatening period of life throughout the entire three-year period of the civil conflict. Monrovia, where most of the amateur radio operators reside, was hit by the heaviest fighting probably ever seen in the 145-year history of the country as rebel forces tried one final attempt to overrun the capital and take full control. Up to that point, the rebels had controlled about 95% of the country, leaving only Monrovia under the protection of the West African Peace Keeping Force—ECOMOG. It was during this period that the radio amateur community, which had just started to regroup itself, had to discontinue their operation within the amateur radio service. For the first time in the long-protracted conflict, the Interim Government banned ham operations for security reasons. Some members of the national radio society, after threat of getting their equipment confiscated, packed their gear away.

At the present time, the Liberian Radio Amateur Association, the country's only national radio society, is trying to rebuild ham radio operation, while the entire country starts its rebuilding process. The amateur radio service will be a major factor in the overall rebuilding and reconstruction process. We, as hams, can play a major part.

[Welcome back! Mahmoud reports that his Liberian address (PO Box 20-4262, 1000 Monrovia 20, Liberia) is still good, but regular mail has a long way to go before service gets back to what it was before the war. If the correspondence is important, use the New York address previously listed.—Arnie]

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. HaNeger 85530

SATELLITE/TECHSAT NEWS: Assi 4Z7ABA has provided the following details on the Techsat project: The Haifa Technion University-built satellite is planned to be launched on a Russian rocket in April of next year. Its orbit will be at the altitude of about 1,000 km and sun-synchronous, meaning that it will fly over the same areas in the world at the same times daily, similar to U.K.'s Surrey University's UoSAT OSCAR 22. The microsat will have aboard a mailbox for radio amateurs working on FSK at 9600 bps and on AFSK at 1200 bps, compatible with conventional VHF FM terrestrial packet operation. The downlink will be on 70 centimeters with uplink channels on 2 meters.

For the past half year, a BBS has been operating terrestrially, imitating the functioning of the Techsat mailbox, and has been giving hams the opportunity to accustom themselves to working full-duplex using the software needed for the Pacsats.

In addition to its ham payload, the bird has planned an earth-photographing camera using a newly-developed picture compression logarithm. It will have, as well, a horizon-measuring detector which will aid the bird in facing earth.

It will be stabilized by magnetorquing electro-magnets that will allow the satellite to align itself with the earth's magnetic field. In the Technion, the magnetorque system was successfully tested with the satellite suspended on a wire, and within three hours it stabilized itself.

For the first half-year after its deployment in space, Techsat will be closed to the public for testing and experiments, which will not take place on amateur frequencies. Afterwards, the BBS should be open for the enhancement of the worldwide satellite packet system.

AN OPEN LETTER TO 4X1RU: After seven years of running a tight ship, Jim 4X1RU stepped down from running the 4X VHF-HF Packet Gateway, which provided a great service to packet hams worldwide as a clearinghouse and main relay station at the junction of three continents. Avi Esterson 4X6UA wrote the following tribute.

"Dear Jim: As you prepare to close down RUBBS and all the associated services, I want to thank you for having given all of us the opportunity to participate in the worldwide packet network through your fantastic operation. I know you ran the station with dedication and skill, putting in countless hours to make it one of the most efficient and well-thought-out HF forwarding stations in the world, making the worldwide network what it is today.

"I know you suffered frustrations, arguments, the idiocy of us the users, and for my share in that I apologize—I hope that ultimately these negative aspects were not the straw that broke the camel's back, but rather that you are moving forward to other interests for positive reasons.

"Your dedication and skill will be sorely missed by all of us who benefited so much from your efforts, and the packet world will be that much poorer for the loss of them. I am sure I speak for packeteers worldwide when I offer my heartfelt thanks. 73 de Avi 4X6UA."

A LETTER FROM 4X6VT: [Corrinne Juday 4X6VT, possibly the world's first YL SysOp, has taken over the HF-VHF Packet Gateway station for Israel. At writing time, the gateway is functioning smoothly, providing the ISRNET VHF Packet BBSs in Israel with a reliable flow of bulletins and mail to and from the outside world. Her letter is written in the midst of the trials and tribulations of learning the ropes.] With the computer connected to the gateway, I have no way of writing articles. Hi! I want you to know though that 4X1KT Gateway Kiryat Yam, in Memory of Zvi Pomer, is on the air and runs like clockwork. Many thanks to all who gave a hand to make it happen, especially Mike, my youngest, handling the computer part and in constant contact with Jim 4X1RU, who is keeping an eye on us from the distance "aiding and abetting." Hi!, the smooth transition from Herzlia to Kiryat Yam.

The Pomer family came to visit the station and were greatly moved and impressed seeing the familiar callsign 4X1KT appearing on the screen at regular intervals. 73, Vee Tee (Corrinne).

P.S. Please note the wholehearted consent to the use of the 4X6ES club station's Cushcraft antenna when not in use for the club from the sponsors WB2MEW Sy and Margy Saslow of New York.

70 CENTIMETRES GAINING AMATEUR OCCUPANCY: To date, many UHF frequencies are now occupied and being used for Techsat, packet BBS and links, and repeaters. It looks like the immediate threat to the band from commercial interests has been thwarted, but the lesson has been learned, and the band is now being more intensively used. *[Does the threat sound familiar to U.S. hams?—Arnie]*

NEVER SAY DIE

Continued from page 4

The early sideband days were an adventure. So were the early NBFM days. And slow-scan, moonbouncing, satellites, 10 GHz, and so on. There isn't one minute of my operating from over 50 countries I'll ever forget. Sitting there in the summer palace near Amman with King Hussein, working the pileups on 20m. Working slow-scan from his downtown palace.

How about QRP? A million or so Japanese are having fantastic times on the low bands with 10 watts. Try it. Keep a log, and let me know how much fun you're having. You can thank me by getting me another subscriber. If every reader recruited one more reader we'd double *73's* circulation and you'd be getting twice as fat a magazine every month. No, the editorials won't be any longer. I'm too busy with *"Cold Fusion,"* and a couple dozen other projects. Like my recording studio, five record labels, a CD sampler program for independent record companies, brokering the making of CDs and cassettes for these indies, and stuff like that.

Then there are at least 50 books stacked up that I want to read. When I run across something outstanding I try to make it available through Uncle Wayne's Bookshelf so you can enjoy it too. I should try harder to get you to check out some of the music I have available . . . it's fabulous. Just as smoking takes an equal time off your life, I suspect that listening to good music will add an equal time for you. No, don't smoke while you're listening to even it out.

Now get off your duff and get adventurous. Pick some aspect of hamming and have at it. And please don't forget to let me know how you make out. I'm interested in your successes and your failures. Remember, nothing ever works right the first time . . . that's why it's an adventure. Buy a kit. Try packet. And the next time you buy some ham gear, keep a log and write about it for me. Share your adventure.

Chicken Little . . .

. . . is at it again. I hear that one of our competitors is busy telling people (for the nth time) that *73* is going out of business. They wish. Sure, I had an employee try to put us out of business so he could start a competing business. That's not the first time that's happened. I remember when Jim Fisk W1DTY, who I'd entrusted to be the general manager and editor while I was on a lengthy DXpedition, made a major effort to put *73* out of business. When he walked out one day, saying he had a job with a test equipment company, I discovered that he'd done some serious mischief. For instance, he hired away most of my staff to work for him as the editor of *Ham Radio*, convincing them I'd be out of business soon. He randomly cancelled several thousand of our subscriptions. He stopped all renewal notices from being sent out for several months, losing us thousands of subscribers. He rejected all submitted articles and then the writers got a letter from *Ham Radio* magazine saying they understood an article might be available, and they were in the market for articles. He bragged to my assistant editor that he was putting me out of business and offered her a job. She stuck with me.

This was the chap that I brought in from California as an assistant editor, even paying for his moving. Then I gave him the down payment for a beautiful home on nearby Lake Monomonock, and paid him well. He talked my editor into leaving and got that job, plus general manager. Fortunately Kayla, my assistant editor, stuck with me, and my draftsman who did the schematics moved in from Missouri so he could work night and day to get schematics done for the magazine. Since Jim left us with not one article for the next issue I had to call friends and get stuff in a hurry.

It was a tough battle, but we got the next issue out on time. Then we had to go over the old subscription records and re-enter the thousands of cancelled subscriptions, one by one. Yes, Jim called our advertisers told them that we were folding, so many stopped advertising.

History, with some differences, is repeating itself. This time *73* is doing fine and it was my CD manufacturing brokering and music publishing businesses that were attacked. Naturally this all happened at the same time as I was getting *"Cold Fusion"* started, so an opportunist tried to grab that publication in the confusion.

I had to stop making trips to music conferences and my DXpeditioning and get back to work. I replaced my CFO and general manager with me, took over as the editor of *73* and *"Cold Fusion,"* put *Music Retailing* on hiatus, and got to work seeing what I could do to start selling a few tons of CDs that were sitting in my warehouse. For instance, I've got a bunch of samplers which I'll be giving away for the cost of packing and shipping. These samplers were made from the top-rated tracks from CDs we've manufactured for independent record companies, so the music is fabulous. I don't know any better way to sell music than to get people to listen to it with these samplers. Since I've started the sampler program the sale of independent music has increased by over $800 million a year, so I think it's helping.

My brokering business is going strong, despite the effort to sink it, so if you ever need any CDs or cassettes made, have I got a deal for you!

My New Ham Shack

I got pretty depressed a couple of years ago when someone broke into my ham shack and stole just about everything. Since then I've made do with an Icom 735 and a vertical. It's a great little rig, but not many stations come back on my first call. It's a whole different world from operating with a kilowatt and a big beam on a 70-foot tower.

So I've cleaned out a room in the barn across the road from my house for a new ham shack and I'm shopping around for a new tower. The DX is pretty crummy these days with the sun-spot cycle in the doldrums, but I am hearing some nice stuff coming through now and then, so I need a big signal. With so much to do I can't afford to trade my time for signal strength. In addition to running my businesses on a day-to-day basis I've got all those books I'm anxious to read.

When you hear me, give me a call and I'll tell you about the time I made that Moscow contact via OSCAR-7. Then I'm going to want to hear what you've done besides make the pileups deeper and the frustration level higher. I want to hear about your adventures in amateur radio.

In Retrospect

There are two times of the year when we tend to stop and think about how we're doing in our lives. Two milestones, or are they millstones? One is our birthday and the other is the New Year. We might do better if we took time more often to contemplate our progress in life and perhaps reset our compasses.

The birthday, as we get older, is mainly another milestone on the way to the grave. It reminds us how fast time passes and how little we're accomplishing. The New Year is a second reminder, usually complete with promises to ourselves to do better (called resolutions).

So here's Wayne, mulling things over as a result of another birthday. I certainly had a more eventful 71st year than I expected, with a few good things happening, and some real miseries. I found that I'd "retired" more than I should. I was having fun giving inspirational talks to musicians at music conferences around the world, going on mini-DXpeditions and getting in some diving in the Caribbean and the Hawaiian Islands, and researching the problems our country is having with crime, education, and health care, and proposing creative solutions. Meanwhile I let others do most of the running of my businesses and personal finances, trusting them and believing the financial reports I was getting.

Bad move. Thinking back, every serious problem I've had in business has resulted from my trusting people. Part of my problem is my lack of interest in money. If you've read any of the stories of my adventures you know I'm cheap. Mmm, let's make that *thrifty*. Just as I have never had much interest in making money, neither have I had any desire to waste it. When I start a new project I try to set it up so it'll make a profit and thus be able to grow . . . and perhaps finance yet another entrepreneurial business that I think is needed.

I hate being tied down with the day-to-day management, so I try to find other people to handle the details, with me being available for advice when they have problems. Then, via weekly meetings and financial reports, I keep track of how things are doing and where my help may be needed. What I haven't protected myself from is two key employees conspiring to put me out of business.

I won't bother you with the details, but it'll sure make an interesting chapter or two for a book.

The most annoying aspect is that this has interrupted my plans for seeing if I can turn out a daily radio program which people will enjoy. I think people will be interested in the history and potential for amateur radio, in the latest medical news on AIDS, cancer, and so on, on ways we can cut taxes, cut prison costs, reduce crime, reestablish family values, eliminate welfare, generate more jobs, promote a new NRA (Never Reelect Anyone) program, and actually reduce the deficit. I think they'll enjoy my picks on the best in new music releases, the more interesting books, the best places to travel, the reality and potential for cold fusion . . . you know, like my editorials.

These are some of the things I talk about at hamfests, where everyone seems to enjoy it. Say, if you are involved with a radio station, would you be interested in giving such a program a test run? It could well be that there isn't much interest in new ideas, books, and music. Or maybe I could give Limbaugh some competition.

But first I've got to find someone to help me keep all my businesses going so I'll have the time to do a radio show. I'll bet I can get us that million new hams we need to make sure we don't lose our bands if I can have a try at it. I'll be needing some tapes of your more interesting rare DX contacts, so set up a recorder and start making some tapes just in case, and be sure to ask for permission to record when you get a hot one. And I'll be needing letters from you about your adventures in amateur radio. Testimonials.

With a million new hams, mostly young, I believe we'd be back in business developing new communications modes and generating the scientists, engineers and technicians we're going to need to keep America ahead of the rest of the world in technology. And with digital techniques, wa might not have any more interference than we do right now. Maybe a lot less.

Like suppose we digitize speech and just send the phonemes. This would allow us to compact the data enormously. Computers can generate some fairly good sounding speech these days. Heck, we could specify how we want it to sound and have it come out with just about any kind of an accent. That should be able to cut our transmission time down by at least 90%, allowing nine times as many contacts to take place. Well, it was just a thought. Probably never happen.

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check Special Events File Area #11 on our BBS (603-924-9343), for listings that were too late to get into publication.

NOV 5

SULPHUR SPRINGS Hopkins County ARC & RAILS will co-sponsor the Northeast Texas Fall Hamfest, 8 AM-2 PM at Hopkins County Regional Civic Center. Setup Fri. 7 PM-9 PM; Sat. 6 AM-8 AM. Talk-in on 146.68- (151.4) and 444.825+ (151.4). VE Exams at 1 PM. Fall meeting of the Board of Directors (Texas VHF-FM Soc.). *Contact Hopkins County ARC, c/o Nathan Bailey, 1510 San Jacinto, Sulphur Springs TX 75482. Tel. (903) 885-3555 after 7:30 PM Central time.*

NOV 5-6

ODESSA, TX The West Texas ARC will hold their 11th annual Odessa Hamfest Convention at Holiday Inn Convention Center, 6201 East Business 1-20. Times: 8 AM-5 PM Sat.; 8 AM-2 PM Sun. Setup 4 PM-10 PM Fri., and 8 AM Sat. For details, call *Robert Jordan N5RKN, (915) 335-7980 eves.*

NOV 6

CARTHAGE, MO A Hamfest will be presented by the Carthage ARS at Memorial Hall, Oak & Garrison Sts. Time: 8 AM-2 PM. Talk-in on 147.42 simplex. Please pre-register for tables. VE Exams. Amateur Radio Gear. Computers. For info call *Jim Dixon WX0J, (417) 358-4126.*

CONCORD, NC The Cabarrus ARS Hamfest/Swap Meet will be held at Cabarrus County Fairgrounds, 8 AM-4 PM. Flea Market. Dealer setup 3 PM-10 PM Sat., 6 AM Sun. VE Exams, all classes, code and no-code, (walk-ins accepted) Register 8:30 AM 9 AM Sun. at the Cabarrus County Bldg., EOC Room, 745 Cabarrus Ave. (adjacent to the Fairground). Bring original and copy of license, any credit certificates, ID. Also bring $5 registration fee payable to the Charlotte VEC. Talk-in on 146.655/.055. For general info, call *Jeff Parker WA1KXI, (704) 933-7238. Dealers, call Bill Hickok WD8SAS, (704) 788-2873.*

NOV 11

FAIR LAWN, NJ The Fair Lawn ARC will hold an Auction from 7:30 PM-11 PM on the Club grounds at 1256 River Rd. Free admission. No VE Exams. Talk-in on 146.790(-). For details, contact *Gary KB2LCA, (201) 791-3841, Fri. eves only.*

NOV 12

MYRTLE BEACH, SC The Grand Strand ARC will sponsor their 2nd annual Hamfest/Computer Show at the Myrtle Beach H.S. from 9 AM-4 PM. VE Exams at 9 AM sharp. Talk-in on 147.120(+). Call *Robert Battle, (803) 236-2887; Gordon Mooneyhan, (803) 293-3839; or write GSARC, P.O. Box 2135, Myrtle Beach SC 29578-2315.*

PLYMOUTH, MA The Mayflower ARC will host its 4th annual Flea Market at the Plymouth Memorial Hall Bldg. in Plymouth Center (RT3A), from 9 AM-3 PM. Dealer setup at 8 AM. Talk-in on 446.625 and 146.685. Contact *Jon WS1K, (508) 746-0162; or Jim NM1F, (508) 747-2224 eves.*

NOV 13

BRANFORD, CT The Southcentral Conn. ARA will hold its 15th annual Flea Market at the Branford Intermediate School, 185 Damascus Rd. Sellers 7 AM; Buyers 9 AM. VE Exams. Reservations no later than Nov. 1st, none by phone. For info, call *Brad, (203) 265-9983,* 24 hrs. For reservations, SASE to *SCARA, P.O. Box 705, Branford CT 06405-0705.*

NOV 19

BILLERICA, MA An Amateur Radio and Electronics Auction will be held 11 AM-4 PM at Bull HN, 300 Concord Rd. Talk-in on 147.12(+). Setup at 9:30 AM (no junk, please). Buyers admitted at 10 AM. Sponsors: Bull HN 1200 RC and Waltham ARA. Contact *Eliot Mayer W1MJ, (508) 851-0183; Email 73210.3104@compuserve.com.*

HOLLAND, MI The 4th annual Westshore Hamfest/Computer Expo will be held by the Holland ARC at Holland Christian H.S., 956 Ottawa Ave. Time: 8 AM-Noon. Setup Fri. 8 PM-10 PM; Sat. 6:30 AM. VE Exams: registration at 8:30 AM, testing at 9 AM. Contact *Westshore Hamfest, c/o Joe Campbell N8TGX, 10413 Northfield Dr., Holland MI 49424. Tel. (616) 772-4928 (after 6 PM).*

SOCORRO, NM The 1994 Socorro Hamfest will be co-sponsored by the Socorro ARA, the Tech ARA, and the City of Socorro. This event will be held 9 AM-5 PM at Finley Gym. ARRL VEC VE Exams for all classes; registration 11 AM-12 Noon, exams at 12 Noon, walk-ins welcome. Call *Kalman AJ5B, (505) 835-5225.* Talk-in on 146.68(-). Flea Market. Demonstrations. Non-Ham Activities. For Hamfest details, call *Dave N1IRZ, (505) 835-1218.*

NOV 19-20

FT. WAYNE, IN The Fort Wayne Hamfest/Computer Expo will be sponsored by the Allen County AR Tech. Soc., and will be held at the Allen County Memorial Coliseum on U.S. 30 in Ft. Wayne. Doors open at 9 AM both days. Setup is Fri. eve. and Sat. morn. Flea Market. Forums. VE Exams. Ladies Events. Con-

tact *John Rufner KB9BNI, (219) 483-6305 (tables); Don Gagnon WB8HQS, (219) 484-3317* (info); or write to *ACARTS, P.O. Box 10342, Ft. Wayne IN 46851*

TAMPA, FL The Florida Gulf Coast ARC will present the ARRL 19th annual Suncoast Amateur Radio and Computer Convention, Sat. 9 AM-5 PM; Sun. 9 AM-3 PM. Place: Florida Expo Pk., in the "Expo-Hall" (formerly Florida State Fair Grounds), Interstate 4 and US-301. VE Exams Sun. 10 AM at The Sheraton Hotel. Bring the $5 fee, *your original* license, your original CSCE certif. and a copy of each; plus 2 forms of ID (one with a photo). Form 610 will be provided. Walk-ins welcome. No reservations needed. Flea Market. Forums. More. Talk-in on the KC4HAZ Rptr System, 146.94, 223.98, 442.275, and 51.72. Back-up will be the KC4QHM Rptr on 147.105. Flea Market contact: *Jean, 1556 56th Ave N., St. Petersburg FL 33703; Tel. (813) 525-5178 (after 6 PM).* Commercial vendors, contact *Bill Smith, 4402 Henderson Blvd., Tampa FL 33629. Tel. (813) 837-4533.*

NOV 26

EVANSVILLE, IN Vanderburgh County Fairgrounds will be the location of the 2nd Annual E.A.R.S. Evansville Winter Hamfest. Festivities from 8 AM-2 PM Central. Flea Market. Commercial Dealers. Talk-in on EARS Rptr Net.; Evansville 145.150(-); Vincennes 146.925(-). Contact *Bev KA9PDG, (812) 479-5741;* or write *EARS, 1506 S. Parker Dr., Evansville IN 47714.*

DEC 3

NORTH OLMSTED, OH The North Coast ARC Fall Hamfest will be held at St. Clarence Church, 30106 Lorain Rd., 8 AM-2 PM. Setup at 0600 AM. Vendors purchasing four or more tables may set up Fri. eve. 7 PM-10 PM. Reservation payments must be received (with SASE) by Nov. 26th. Send to Dan Sarama KB8A, 15591 Rademaker Blvd., Brook Park OH 44142. Call *Dan Sarama KB8A* at *(216) 267-5083*, or connect to the *NCARC Packet BBS, "C NO8M"* on 145.73. *Dial (216) 779-6350* and use the commands: D *NCARC/HAMFEST.LOC* and *D NCARC/HAMFEST.INF.* Talk-in on 145.29 and 224.76 Rptrs.

DEC 4

HAZEL PARK, MI Hazel Park H.S., 23400 Hughes St., will be the location for the 29th Annual Swap and Shop sponsored by the Hazel Park ARC. Admission $4, tables $13 (check must be sent, no reservations by phone). Talk-in on 146.64(-) (DART). For info, tables, tickets, write to *HPARC, Box 368, Hazel Park MI 48030.*

SPECIAL EVENT STATIONS

OCT 30-NOV 19

MODBURY NORTH, AUSTRALIA The North East RC (Adelaide, Australia) will operate Station VI5AGP for the Tenth Adelaide Grand Prix. Operation will be from Oct. 30th-Nov. 19 on HF and VHF. To obtain an award, contact the station and receive a sequence number. Send $5A or 5 IRCs, quote the sequence number, QSL info, and your return address. The award features the late Arton Senna. Write to *North East Radio Club, P.O. Box 36, Modbury North 5092, Australia.*

OCT 31-NOV 1

BREVARD, NC The Transylvania County ARC will operate Station KD4ZY, from Transylvania County NC. Time: 2100Z Oct. 31-0100Z Nov. 1. Frequencies: 7.234, 14.295, 21.365, and 28.335 SSB; and 146.52 FM simplex. For a certificate, send a legal size or 9" x 12" SASE to *Willis B. Casey KD4ZY, 116 Campbell Dr., Pisgah Forest NC 28768.* Operation will be from the Devil's Courthouse on Blue Ridge Pkwy., weather permitting.

NOV 5-7

WICHITA, KS The Wichita ARC will operate W0SOE from the Wichita Boathouse. The Station will commemorate the world's first all female yacht racing team aboard the America 3. Operation will be on the final day of the World Cup yacht races. Time: Nov. 5th, 10 AM-5 PM; Nov. 6th, 1 PM-5 PM. Freqs. include lower portions of General phone subbands on 20 and 15 meters, and Novice phone subband of 10 meters (propagation permitting). QSL with SASE to *KD0AY, 1603 Fairview, Wichita KS 67203.*

NOV 11-20

PALMDALE, CA Several SE stations will be sponsored by the Northrup Grumman ARC to commemorate the union of the Northrop and Grumman ARCs. Operating: M-F local lunchtime, Sat & Sun 8 AM-8 PM localtime: EST (WA2LOO) Great River and Bethpage NY; CST (W9RSU) Rolling Meadows NY; and W6VPZ Hawthorne; W6VPZ/6 Pico Rivera, and W6VPZ/6 PMD Palmdale CA. Freq.: Top 25 kHz on Novice and General Bands (SSB and CW) 80-10. Contact four of the 6 NGARCs. For a QSL, send contact numbers and QSL with a 9" x 12" SASE (for a parchment certificate) to *Cam Harriot, LL824/4c, 3520 East Ave. M, Palmdale CA 93550.*

NOV 12

VIC., AUSTRALIA The Australian Ladies' ARA will sponsor a contest from 0001 UTC-2359 UTC. Object: YL works everyone, OMs and Clubs work YLs only. Phone and CW. Bands to be used are 3.5, 7, 14, 21, and 28 MHz only. Freqs.: 28.380/.410, 21.170/.200 and 21.380/.410, 14.250/.280, 7.070/.100, 3.560/.590. Procedure: Phone: call "CQ ALARA CONTEST." CW: YLs call "CQ TEST ALARA." OMs call "CQ YL." For further rules and details, contact *Mrs. Marilyn Syme VK3DMS, P.O. Box 91, IRYMPLE 3498, VIC. AUSTRALIA.*

NOV 26-27

WHITMAN, MA The Whitman ARC, Inc. will operate WA1NPO at Plimoth Plantation in Plymouth MA to commemorate Thanksgiving Day. Freq.: 3.970, 7.270, 14.270, 18.140, 21.370, 24.970, and 28.370. Operation will be 1400Z-2100Z both days. For a 7 1/2" x 10" Certificate with the Mayflower II in the background, send an SASE to *Whitman ARC, P.O. Box 48, Whitman MA 02382.*

Number 25 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

November propagation does not look very promising. The sunspot number continues to drop toward minimum (expected sometime in '95-'96) and autumn equinox conditions are trending toward winter conditions and maximum hours of darkness for the year. The *best* days for propagation are likely to be the 5th-8th, 14, 15, and 25th-30th. The *worst* days appear to be the 2nd, 3rd, 10th-13th, 17th, 18th and 21st-24th.

General Conditions this Month

10 and 12 meter bands: Occasional F2-layer openings to the tropics during daylight hours. Morning and afternoon hours likely to be open on Good or Fair-to-Good days.

15 and 17 meter bands: Fair-to-Good DX openings on Good days, particularly from noon to sunset. Band closes shortly after sunset. Some short skip during daylight hours.

20 meter band: This will be your best band for DX opportunities, and DX to all areas of the world during daylight hours on Good days. Peak conditions an hour or two after sunrise, and again during early afternoon hours. Sporadic E/short skip out to 2,000 miles during daylight hours on Good days. Not much after dark.

30 and 40 meter bands: Late afternoon and early evening openings to the east (Europe and Africa) on Good days. Openings to Asia, the Pacific and the Far East should peak before sunrise. Daytime short skip to about 1,000 miles and nighttime short skip to 2,000 miles on Good days.

80 and 160 meter bands: Eighty meters should provide excellent openings after dark, peaking for DX around midnight and again just before sunrise. The low static levels of winter will be a big help. Short skip during daytime to 500 miles and up to 2,000 miles after dark. One-sixty will be closed during the daytime, but will open after dark with short skip up to 1,500 miles. DX to the east peaks around midnight, and to other directions before sunrise, local time, on our top band. Be prepared.

In spite of the conditions as outlined above, or perhaps *because* of these conditions, seasoned DX operators should be alert to sudden openings of short duration, and will often call CO when the band appears "dead," with surprising results. Grey-line DXing is always possible where the darkness path to various areas of the world from the USA exists. Usually, about a half hour before dark to a half hour after, and a half hour before sunrise to a half hour after, will provide good grey-line DX opportunities.

When using the chart accompanying this report, be aware that the days marked Good, Fair or Poor, or trending between these values, may actually occur a day or so before or a day or so after the days shown on the chart, as forecasting is not as precise as we would like it to be. There are always surprises, so it's very important to closely monitor "conditions" on WWV at 18 minutes past any hour for the latest reports of the solar flux and Boulder K and A values. These, together with the charts here, will be a big help to your DXing efforts. W1XU.

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20						20					15
AGENTINA	20	40A	20	40					15		20A	20A
AUSTRALIA	20	40A		40	40	20	20	20		20	15	15
CANAL ZONE	40A	40A	40	40	40		20	20A	15	15A	20A	20
ENGLAND	40	40	40	40				15	20A	20		
HAWAII	20	20				20	20			15	15	15
INDIA						20	20	20				
JAPAN	20					40	20				15	15
MEXICO	40A	40A	40	40	40		20	20A	15	15A	20A	20
PHILIPPINES							20					
PUERTO RICO	40A	40A	40	40	40	20	20A	15A	15A	20A	20	40A
SOUTH AFRICA	40	40A	20					15A	15A	20A	20A	20A
U S S R	20	20					20	15			20	20
WESTCOAST	20A	20	40	40	40	40	40	20	15	15A	15A	15A

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20				40	40	20	20			15	15
ARGENTINA	20	40	40	40						15A	20A	20A
AUSTRALIA					40	40	20	20	20		15	15
CANAL ZONE	40	40	40	40	40	20	20	15	15A	15A	15A	15
ENGLAND	40	40	40	40				15	15	20A	20	20
HAWAII	20	20	20	40	40		20	20		10	10	15
INDIA	20	20					20	20				
JAPAN	20					40	20	20				15
MEXICO	40	40	40	40	40	20	20	20	20	15A	15A	15
PHILIPPINES	20A	20					20	20			15	15
PUERTO RICO	40	40	40	40	40	20	20	20	20	15A	15A	15
SOUTH AFRICA							10	15A	15	20A	20A	20
U S S R							20	20A	15	20	20	

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20A	20A	20			40	40	40A	20	20	20	20A
ARGENTINA	20A	20	40A	40						15A	15A	15A
AUSTRALIA	20A	20A	20	20	40	40	40		20	20	15	15
CANAL ZONE	20	20	40A	40A	40			20	20A	15A	15A	15A
ENGLAND			40					20	15	20A	20	20
HAWAII	15	20A	20A	40A	40	40	40	20	20	20		15A
INDIA	20A	20A						20	20			
JAPAN	20A	20A	20			40	40	40A	20	20	20	20A
MEXICO	20	20	40A	40A	40			20	20A	15A	15A	15A
PHILIPPINES	15			20		40	40		20	20		
PUERTO RICO	20	20	40A	40A	40			20	20A	15A	15A	15A
SOUTH AFRICA	20							20	20	15	20	20
U S S R			40	40				20A	15A	15	20	20
EAST COAST	15A	20	40	40	40	40	40	20	15	15A	15A	15A

A = Next higher frequency band may also be useful. G=Good, F=Fair, P=Poor

NOVEMBER 1994

SUN	MON	TUE	WED	THU	FRI	SAT
		1 F-P	2 P	3 P-F	4 F-G	5 F-G
6 F-G	7 G	8 G-F	9 F	10 F-P	11 P	12 P
13 P-F	14 F-G	15 G-F	16 F-P	17 P	18 P	19 P-F
20 F-P	21 P	22 P	23 P	24 P-F	25 P-F	26 F-G
27 G	28 G	29 G	30 G			

Number 26 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old-timer happy with that ng you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, *73 Magazine*, 70 Rt. 202N, Peterborough NH 03458, and get set for the phone calls.

The deadline for the December classified ad section is October 13, 1994.

ALL ABOUT CRYSTAL SETS. Theory and construction of crystal set radios. $9.95 each, ppd USA. Send to: **ALLABOUT BOOKS**, Dept. S, P.O. Box 22366, San Diego CA 92192. BNB200

CUSTOM MADE-HAND TOOLED leather products with your initials, name, call letters. Photo's & estimates available. Key rings, wallets, belts, purses, hanging signs, specialty items. **GREAT GIFT. LEATHER & WEST**, 67 Causeway Rd., West Swanzey NH 03469. (603)352-6256. 9-4 pm. M-F ET. BNB215

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette. $12.00. **LEARN MORSE CODE IN 1 HOUR.** Amazing supereasy technique. $12.00. Both, $20.00. Moneyback guarantee. Free catalog: SASE. **BAHR-T7**, 150 Greenfield, Bloomingdale IL 60108. BNB221

ROANOKE DOPPLER PC BOARDS $49.95 ea. AB5CK, 6721 Rolling Hills Dr., North Richland Hills, TX 76180. BNB240

WANTED: AUDIO EQUIPMENT. Tube, Solid State, McIntosh, Marantz, Tannoy, EV-Patricians, Western Electric, Nakamichi preferred. John, (410)465-2699. BNB268

KPC-3 WINDOWS TERMINAL PROGRAM User friendly Split Screen, 400 line Scrollback Buffer, Save & Send files easily, 3D Command Buttons, $29.95 or SASE for **FREE** details. **COMTREK** P.O. Box 4101, Concord NH 03302-4101. BNB271

QSL SAMPLES- 50 cents. **SAMCARDS**, 48 Monte Carlo Dr., Pittsburgh PA 15239. BNB275

DWYER WIND SPEED INDICATOR only $55.00 plus $4.00 S/H. For home or office. Accurate, low-cost, practical. Root mounted pickup. Send check or M.O. to: **RAD-MON COMPANY**, Dept A, Box 751, Marathon NY 13803-0751. (NY Residents add Sales Tax) BNB285

ATTENTION HAMS! Subscribe to *6-50 Worldwide for Six Meter Enthusiasts*, *DX Digest for DX Chasers*, or *The Novice/Tech Report*. Call (817)694-4047 or FAX (817)694-2522. BNB292

COMMODORE 64 REPAIR. Fast turn around. **SOUTHERN TECHNOLOGIES AMATEUR RADIO**, 10715 SW 190th Street #9, Miami FL 33157. (305)238-3327. BNB295

KIT BUILDERS— NEW, SYNTHESIZED qrp Transmitter/Transceiver, the **ARK4**. Full Transceiver Kit w/case only $199.95. One board, no wiring, top quality components & PCB. **GUARANTEED TO WORK.** For info send SASE; Call/Write to order: **S & S ENGINEERING**, 14102 Brown Road, Smithsburg MD 21783; (301)416-0661. BNB304

WANTED: Electron Tubes, ICS, Semiconductors. **ASTRAL**, P.O. Box 707ST, Linden NJ 07036. Call (800)666-8467. BNB307

KENWOOD AUTHORIZED REPAIR. Also ICOM, Yaesu. **GROTON ELECTRONICS**, Box 379, Groton MA 01450. (508)448-3322. BNB310

UNIQUE INDOOR/OUTDOOR ANTENNA gives 30 dB gain on 160m-10m. Plans: $6.95. **BOB CHRISTIE AA2KE**, 215-28 Spencer Ave., Queens Village NY 11427. BNB319

GMRS: ALTERNATIVE TO CB AND HAM RADIO. Great for traveling, camping or other family use, 2ed. Send $3.00 to: Neiferd, KG8EP, 2695 Haystack Dr., Colorado Springs CO 80922. BNB326

PROGRAMMABLE COUNTER— Works with ANY VFO Rig! Get a digital display for your rig, 100 Hz resolution. You can read the tuned frequency directly, no need to calculate offsets. Counts to 40 Mhz, up **OR** down. Counter Kit, $69.95; Kit w/case, $99.95; Assembled w/case, $139.95. **GUARANTEED TO WORK.** For info send SASE: Call/write to order: **S & S ENGINEERING**, 14102 Brown Road, Smithsburg MD 21783; (301)416-0661. BNB334

Continued on page 81

Number 27 on your Feedback card

NEW PRODUCTS

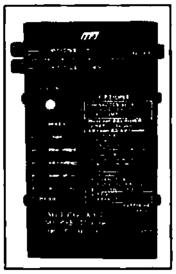
Compiled by Charles Warrington WA1RZW

MFJ ENTERPRISES

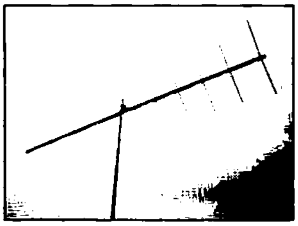
Here comes an excellent opportunity for you to learn or to perfect your Morse code skills! The MFJ-411 Personal Morse Code Tutor will take you from zero to expert speed, from beginner to Extra Class, utilizing a custom code practice technique.

The Random QSO Mode allows you to start by practicing plain English QSOs to get you ready for the FCC exams; the Word Recognition Mode allows you practice copying entire words—just like the pros on 40 meters!

You can take the 411 anywhere—it measures only 3" x 1-1/8" x 5-1/2". The Tutor runs off a 9V battery or from the optional MFJ-1312B 110V adapter. You can use it with the built-in speaker or with earphones.



The MFJ-411 Personal Morse Code Tutor is priced at $79.95. For more information or to order contact your favorite dealer or *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (601) 323-6551, or (800) 647-1800.* Or circle Reader Service No. 201.



LIGHTNING BOLT ANTENNAS

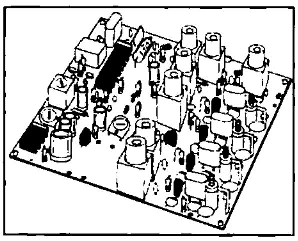
Lightning Bolt Antennas has added two new 10-element quad antennas to their product line. The 2 meter quad has a measured gain of 14 dBd. It is equipped with a 12-foot filament-wound Fiberglas boom and solid 3/8" Fiberglas spreader arm rods. These spreaders are slotted on the ends so the wire elements pop on with tension—they hold tight. A 220 MHz version is also available.

These antennas come complete with stainless steel hardware and an aluminum boom-to-mast bracket. They are priced at $99.95 for either model. For more information or to order contact *Lightning Bolt Antennas, Rd. 2, Rt. 19, Volant, PA 16156; (412) 530-7396.* Or circle Reader Service No. 204.

HAMTRONICS

If you are looking for an inexpensive, but very effective wideband FM receiver for 137 MHz weather fax reception, the new R138 Receiver from Hamtronics may be the answer. Because a wide IF bandwidth is required in this type of receiver for good quality reception, many conventional receivers and scanners are unsuitable without modification.

The R138 Receiver is crystal controlled; it has four channel oscillators, which allow you to select a particular satellite by simply grounding the appropriate control line by an external switch. Crystals are available for all the popular satellites and simply plug into sockets. The receiver also has very



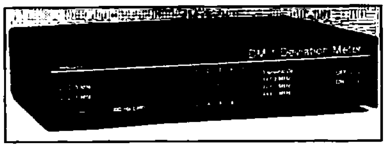
good sensitivity, typically 0.2 µV.

The kit price is $99, or wired and tested for $169. For more information, catalogs, or to order contact *Hamtronics, Inc., 65-D Moul Rd., Hilton, NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.* Or circle Reader Service No. 206.

JAN CRYSTALS

JAN Crystals is now offering a line of Temperature Controlled Crystal Oscillators (TCXOs). JAN's TCXOs maintain a very stable frequency as ambient temperature changes, making them ideal for use in FM modulators, pulse code modulators, video cameras, measurement systems, portable radios, and a host of other projects.

The oscillators operate in a frequency range of 10 to 20 MHz and provide frequency stability of ± 2.5 ppm over a temperature range from -30°C to 75°C. Complete specifications and further information is available by contacting *JAN Crystals, P.O. Box 60017, Fort Meyers, FL 33906-6017; (800) JAN-XTAL.* Or circle Reader Service Card No. 207.

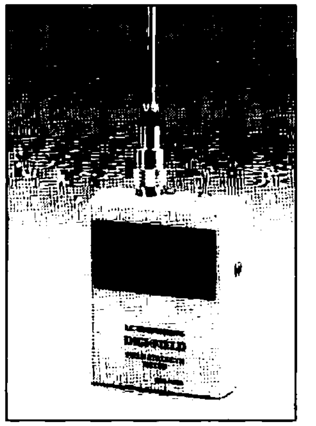


ADVANCED ELECTRONIC APPLICATIONS

The new AEA DM-1 Deviation Meter is designed for measuring the deviation of FM transmitters operating in the 144, 220, or 440 MHz amateur bands. "The people using 9600 baud TNCs will benefit most from the DM-1," explained AEA's Kevin Cox, "because correctly setting deviation for 9600 baud packet operation is nearly impossible to do by ear." The DM-1 allows you to easily set deviation, eliminating excessive retries, increasing data throughput, and increasing channel efficiency.

The DM-1 has crystal controlled tuning, providing for stable measurement without the need for manual tuning. It comes with a 10 segment LED bar display, and has an external output for digital or analog meters.

The AEA DM-1 Deviation Meter is priced at $169. For more information or to order visit your favorite dealer or contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Lynnwood, WA 98036; (206) 774-5554, FAX (206) 775-2340.* Or circle Reader Service No. 202.



I.C. ENGINEERING

The DIGI-FIELD Digital Field Strength Meter from I.C. Engineering has a frequency response of DC to 12 GHz, making it useful for preliminary susceptibility compliance measurements. Model A has a sensitivity of 150 nanowatts at 100 MHz and Model B has a sensitivity of 2 nanowatts. The new Model C combines the sensitivity of Models A and B.

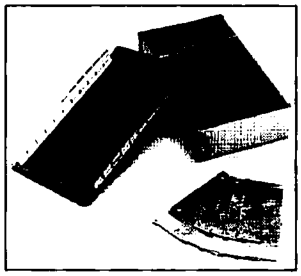
The DIGI-FIELD 3-1/2 digit display is an easy-to-read feature of this compact, lightweight, 9V battery-powered unit. It can be used with an external antenna or with its own movable telescoping antenna. A low battery Indicator and detector output jack are standard. Typical calibration curves in dBm and volts/power conversion charts are available.

The DIGI-FIELD Model C is priced at $139.95. For more information or to order contact *I.C. Engineering, 16350 Ventura Blvd., Suite 125, Encino, CA 91436; (818) 345-1692, FAX (818) 345-0517.* Or circle Reader Service No. 203.

SESCOM

Home-brewers can keep the RF from getting into or out of their latest project with an RF tight, hot tin-plated steel box from SESCOM. The new SB series of RF Shielded Steel Boxes allow the designer to eliminate the typical spillover of unwanted signals. The boxes come with individual dividers and the lids can be soldered to the case.

Eleven sizes are stocked, ranging from 2.1" x 1.9" x 1.0" to 6.4" x 2.7" x 1.1" and are priced from $4.50 to $13.20. For more information, to request a 1995 catalog, or to order contact *SESCOM, Inc., 2100 Ward Drive, Henderson, NV 89015-4249; (702) 565-3400, FAX (702) 565-4828.* Or circle Reader Service No. 205.



COMTREK

ComTrek, a new Windows terminal program for the Kantronics KPC-3, is a user-friendly software program for packet radio communication. It features split screen, 400 line scroll back buffer, user programmable auto connect and macro screens, save-to-file and print screens, on-line editor, and many other features. Files can be uploaded from disk, or directly from the editor.

The ComTrek program is full color or gray scale and has 3D command buttons across the top of the screen for the most often used commands. This is the latest software program from ComTrek for anyone using a KPC-3 who has an IBM or compatible computer running Windows. The price is $29.95, shipping included (within the US). For more information or to order contact *ComTrek, P.O. Box 4101, Concord, NH 03302-4101.* Or circle Reader Service No. 208.

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Oak Hills Research

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December 1994
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Would you like to combine beautiful scenery with hamming, camping and bicycling? Turn to page 56.

On the cover: Build your own Oak Hills Classic dual-bander. A review begins on page 14. (Photo courtesy of KE8KL.)

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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Contract: You have entered into a binding agreement with Uncle Wayne and the team to heat up your soldering iron and build a kit. It's fun and rewarding. Learn more, starting on page 10.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Yes, I'm an Optimist!

I've been accused of being a doddering old man with a Pollyana approach to life. Now I admit that I'm a crummy businessman. Always have been. Oh, I know what I should do to make money, but never having had much interest in money, I've always tended to avoid that aspect of business and depend on others to manage the day-to-day business and handle the accounting . . . including my personal investments. And that has encouraged people with scruple deficits to take advantage of the situation, causing me periodic traumas.

I'm enthusiastic about helping to promote new technologies, as I have in the ham radio field with sideband, solid-state, RTTY, NFM, SSTV, repeaters, and so on. As I have with computers, compact discs, and now cold fusion. And I happen to think that amateur radio holds an important key to getting America more competitive with countries like Japan, so I've been plugging for ham growth, particularly for youngsters. I believe that only by generating at least a million new, young hams will we have a good chance of holding onto our ham bands. And whether any of them can copy 13 per is irrelevant. America needs a high-tech work force, not skilled brass pounders.

Yep, I'm old, but I'm not exactly doddering . . . yet. I get out every morning soon after sunup and jog a couple of miles up and down our challenging New Hampshire hills. And I usually put in 100-hour work weeks, just like I did 50 years ago. It's just that for the last couple of years I've been more interested in finding solutions to our country's social problems . . . like crime, drugs, welfare, the deficit, our crooked Congress, wasted foreign aid money, health care, our lousy school system, and so on. And then I got involved in starting a magazine to help cold fusion get out of the laboratory and into production so we could start getting rid of the pollution caused by coal, oil, gas, and even nuclear power. No more smog some day?

When some people I trusted got together recently to try and put me out of business so they could start businesses in competition, I had to clean house and take over as CFO, general manager, *73* editor, and so on. Oh, I can do it, I just peter doing creative things to running a bunch of businesses. In addition to managing *73* and *Radio Fun*, there's Uncle Wayne's Bookshelf, the Golden Recording Studios, the Independent Music Producers Syndicate (IMPS), with mail order, distributing, samplers, and manufacturing divisions. Then there's *"Cold Fusion"* and the editor who left to try and start a competing magazine. Fortunately John Kane AB3C stepped in as the new tech editor. He's a retired physics professor who's worked at several universities and put in a few years at Brookhaven and Bell Labs working on particle physics.

Sure, I have my hands full bailing out the mess, but I enjoy a challenge. And once I have everything running fairly well I'll be looking for someone to take the reins so I can write more books, do more teaching, and even try doing a radio talk show.

I was not surprised when hamdom's pinko version of the *Enquirer*, with about as much scruples and credibiliy, interviewed a couple of *my* ex-employees . . . who were a major part of the problem, and published a personal attack on me. If any potential employers ever ask me for a recommendation I'll send 'em a copy.

Are You Being Paid Enough?

I've gotten paychecks all my working life but, in thinking back, I've never worked *for* a paycheck. The pay was always icing on the cake. I enjoyed my jobs so much I'd have done 'em for free. My first real job was with GE, back in the summer of 1942, testing and tuning transmitters for the Army. Working on radio gear wasn't work, it was great fun . . . and I got paid too!

Then, with some not too gentle pressure from my draft board, I left college and joined the Navy. There I was paid a pittance to learn electronics in what I believe was the best electronic school in the world. Then I operated and serviced radio, sonar, and radar equipment on a submarine, making five war patrols. Work? Ha! Room, board, travel, education . . . and I got paid. There was a good deal of excitement and danger too, making it more fun. You can read about that in my book, *Uncle Wayne's Submarine Adventures in WWII*.

The government paid me to go back to finish college for two years, then I got my first post-war job as the chief engineer of WEEB in Southern Pines, NC. I was only being paid 50¢ an hour, but I had a ball as an engineer-announcer. I'd have done it for nothing, even with those 90-hour weeks.

> **"If you do what you enjoy, and get good at it, the chances are you'll end up with far more money than you ever expected."**

Next I put WPIX (TV) in NYC on the air as chief cameraman. Wow, was that fun! By then I was being paid a big $70 a week to have fun. At WXEL in Cleveland I made $80 a week as a TV director. And about the same at KBTV in Dallas as a director, Then there was a stint at Airborne Instrument Laboratories as an engineer, where I pulled down around $90 a week managing Air Force radar and radio development projects. That was fun, and frustrating. I saw endless millions of dollars being wasted, with the Air Force happily picking up the tab, no questions asked. I really hate to see money wasted . . . probably an old Scotch gene that's kicked in.

But how about you? Are you working for a crummy paycheck, or is the pay just a bonus for doing things you enjoy? If you aren't anxious to get to work every day, and hate having to leave, maybe it's time to re-evaluate. Maybe it's time to look for "work" that *is* fun for you.

When I took over as the editor of *CQ* in 1955 I was being paid only $10,000 a year, but what fun. Imagine, getting on the air and operating as part of the job description. Going on DXpeditions, ditto. Getting to test the latest ham gear. Nirvana. It's no wonder when I got fired from that job in 1960 that I soon started my own ham magazine. I still love trying out new gear, getting involved with new technologies, talking at ham clubs, hamfests, and conventions. That's work? Har-de-har!

And though I've never done any of these things because of the money, for some reason the money has always *come in. Oh, sure*, I've gotten into financial binds now and then because I haven't paid much attention to the accounting, but it's never taken long to get things perking again. At times far more money that I ever dreamed of has poured in.

If you do what you enjoy, and get good at it, the chances are you'll end up with far more money than you ever expected. And you'll also find that there are plenty of unscrupulous people who *are* money-oriented who will try to steal it from you.

Speaking (well, writing) about my days at WEEB, one of the writers at the station had had a play produced on Broadway. "Men Of Iron." It was about building a skyscraper. When I quit to work for WPIX in New York, Joe came to visit me and show me the script for a new play he'd written. It was about Van Gogh. Unfortunately he put it on the seat of the subway train and forgot it when he got off at my stop. And that was in the days before photocopiers and word processors, so it was his *only* copy.

It was never turned into the BMT lost and found, but about three years later his exact play appeared as a movie, so someone found it.

While I was working for WPIX I got to know a chief of detectives in New York who had an idea for a TV series. True-life stuff. For instance, he explained how they were able to get confessions from even the toughest criminals by taking them around the corner from the station house to a dentist who would drill the suspect's teeth without anesthetic *until* he *confessed*. Then he'd fill the holes and no one could prove anything. Thought you'd like to know about that.

How's Your Geography?

One of the more exciting aspects of amateur radio is our ability to make friends just about anywhere in the world. A good DXer gets to know every country, and just about every island in the world. So here's a little test (Figure 1, page 76) for you to see how you're doing. No fair looking 'em up. Three points for each you get correct.

Yep, there are some toughies.

Continued on page 76

LETTERS

Number 2 on your Feedback card

From the Ham Shack

Fred Weinberg, Tulsa OK Wayne, while I am not a subscriber, I am a reader and follower of your career. My first radio was a Heathkit Twoer, converted for use for the Civil Air Patrol, and that led me to a career in communications in which I've owned broadcast and print properties.

Currently, I'm helping restore AM radio to its original place in the scheme of things under the theory that if you give me a transmitter that a lot of people can tune in, we'll find a way to capture thai audience. It helps that the big boys have abandoned AM as dead because it brings the prices down.

I figure that spread spectrum and digital compression will make TV broadcasters of us all, so it's really the software that counts.

When I think of how far we've come from the days of that Twoer (and, by the way, 72 isn't very old—that's how old Bob Dole will be when we elect him president in 1996), I marvel that there is a place for people who really don't want to work for big companies. But there is.

Wayne, your career has been an inspiration for many of us who would rather not work for anyone but ourselves and I hope that you realize that what you do has an influence far beyond the field of telecommunications.

I hope to read your editorials—fine print and all—well into the future.

Jonathan Walter, Prince Rupert, BC, Canada I've found out personally about the mess in the school system you've been writing about in your editorials. Although I graduated last year, I still am involved with my school. A couple of my friends are teachers there and I am tutoring grade 12 math students. One of those teachers actually helped me in last year's guerrilla attack. He read Gatto's book and agrees with everything in it, but his hands are tied. A few nights ago we got to talking about the situation. I've seen firsthand that the worst damage has already been done by the time kids hit high school. My teacher friend was describing how he would bring in really neat stuff from outside the normal boring curriculum, such as videos and visitors . . . the head of a $1,000,000-per-year project, for example. The kid's questions weren't about the exciting scientific work he was doing; they wanted to know, "How much money do you make?" While he was explaining about his work, the students talked among themselves and otherwise ignored him, except when he touched on sex, violence, or explosions, then he had their rapt attention. In my math tutoring, I've found they teach nothing but the most fundamental arithmetic in elementary school, so by the the time students hit grade 12 they don't have a foundation for learning to understand and use the new stuff. Grade 12 math is literally a whirlwind tour of all the topics that really need a couple years to soak in. I asked my former math teacher about the curriculum, and why so and so wasn't included, since it would make learning the other things easier. She reminded me why by taking me back to the trivial textbooks that are used in the previous high school years. In other words, those years had been wasted, so all she can really do is push stuff at her grade 12's to memorize so they can pass their provincial exams and she can look good.

In Surrey, a suburb of Vancouver, BC, parents have set up a traditional school, one with discipline and curriculum that go back decades. They did this in spite of intense opposition from the teachers' union. They do realize there's something wrong with the public school system.

Hmm, maybe it isn't just the code that's a barrier keeping kids away from hamming. Maybe the math is too tough. That Ohm's Law is a toughie, right? . . . Wayne

Richard Gillmann KI7KJ, Issaquah WA Wayne, I enjoy reading your "Never Say Die" column every month in *73*. You've often written about how the growth of amateur radio and school radio clubs stopped in the early 1960s. While, no doubt, incentive licensing had its effect, another factor influenced me at the time.

I was in a high school radio club in 1963, at Homewood-Flossmoor High School in Illinois. My friends and I were fascinated by electronics, and we were studying the code and theory for our Novice licenses.

One day, our school announced a weekend program that would let us use the computer lab at the Illinois Institute of Technology. We could run programs on their IBM 1620 and later IBM 7044 computers. All we had to pay for were blank punch cards. (Remember, this was the Stone Age of computers!)

We all jumped at the chance. We were down there every Saturday. Soon, we knew more than the teachers. It was exciting, it was the forefront of technology, and it turned into a career for me.

The radio club, neglected, went into a tailspin. The new computer technology was more interesting to us than the old radio technology. The generation of kids that followed us had teletypes connected to time-sharing systems, and the generation after that had personal computers, to make the experience even more enticing. Now they have the Internet.

I did eventually get my Novice license, but never operated. In the '80s, I got an Advanced ticket so that I could try packet radio. I built a TAPR TNC-2 kit, figured out how to wire a cable to my Icom IC-2AT, and connected to all the PBBSs I could reach on 2m. I was disappointed to find out how dull the PBBSs were, compared to telephone BBSs and to the Internet. There weren't many callers, and what they had to say wasn't very interesting.

For amateur radio to thrive, we need to find a way to make it more appealing to computer hobbyists. You don't need a license to access the Internet; there are no restrictions on message content, and you can automatically forward anything. This is what we have to compete with. Recent FCC rulings have been in the right direction: no-code Techs, and relaxed rules for message content and automatic forwarding. I'd like to see the FCC go further in this direction.

Here's my proposal: For the ham bands above 500 MHz, eliminate the license requirement entirely, and remove all restrictions on message content and forwarding. These UHF/SHF bands could benefit from more activity. The originator of a message would be solely responsible for its content.

This would lead to a great expansion in wireless computer networking by amateurs. More participants gives you more people to write to and chat with, more varied postings, more files to download, and richer content in general. A bigger network works better in emergencies, too. We could have a big branch of the Internet over the radio, accessible for free to anyone with a computer, a radio and a TNC. Now, that would be exciting.

Tom Prentiss, Calvert City KY Wayne, I recall when *73 Magazine* was about 5" x 8" in size, and the cover price was $.37. I had always enjoyed your outlandish editorials, and was a particularly big fan of yours when you were trying to establish a counterpart to the ARRL. I even drove to Peterborough one summer to interview with you for the director's job of that fledgling organization.

Having the usual excuses for not keeping up with that hobby, (except for faithful renewal of the license) I've only recently begun to rekindle my interest, and for the first time in years I've bought a ham magazine (*73 Amateur Radio Today*, October 1994). I congratulate you, in your advanced age, for maintaining your sense of humor and provocative thought process.

I'm certainly aware that *73* is a ham magazine, and should mostly be oriented to that pursuit; however, since you are asking for the readership to submit ham projects and articles for publication, why not go one step further? Why not solicit features of *any* type for publication? After all, you are the one constantly admonishing others to get off their duff and do something productive. You also surely know that many ham readers simply do not have the expertise to write something of a technical nature. There may be a Hemingway in the wings., and for all the bureaucracy involved in the normal publishing merry-go-round, unable to get published. Enter Wayne Green, and *73* magazine. Sure, there would be some costs involved, for logistics and compensating the author (me, pay?), but I can foresee the readership, and the number of subscribers, growing.

For more than 30 years I've been chiding myself to write to Uncle Wayne, and I've finally done it. I imagine your hope is that it will be another 30 before I do it again.

Tom, Thanks for the nice letter . . . glad you've been enjoying my editorials, even when they have little to do with amateur radio. Well, I can't help sharing my enthusiasms.

I would like to see ham-oriented stories, poetry, cartoons, photographs, and so on. But, if I get too far afield I'll get beefs. True stories, fiction, fantasy and humor will be welcome . . . . Wayne

George Zimmerfee N4XDC, Marietta GA Some of us are wondering how you will respond to this letter. Everyone knows that you hate the League. Some also know you hate traditional values and Christians. It is anybody's guess how you're going to land on this one, but here goes: I have proof that the FCC and the FBI worked together to jam amateur radio service stations AB5LA and AB5KZ at EE Ranch Road, or RR7, Box 471-B, Waco, TX 76705. This is also known as Mount Carmel Center, the church/home of the Branch Davidian Church. Also in this same jamming operation, already admitted by an FBI special agent on April 17, 1993, was the jamming of radio and TV stations for political reasons, (this also has been admitted) as part of their psychological operations.

The amateur station was operating under sections 97.1, 97.11, 97.113, 97.301, 97.403, 97.405 of the Amateur Radio Service rules. This is the Communications Act of 1934. Also violated by Big Brother were Articles 44 and 45 of the International Radio Regulations, and Article 19 of the International Covenant on Civil and Political Rights.

Mark Wilson, Editor of *QST*, knows that the amateur service was a victim of this deliberate interference to a "station-in-distress" in the amateur service. Wilson just doesn't care about this war of the tyrants in government against the amateur service. This should not be any surprise to either of us, but I found it interesting that the League would put itself in jeopardy by refusing to print anything about the jamming. Not one word of it will be printed, not even the part already covered by the mainstream news media.

I have some hope that you will pull through and be consistent in your opposition to league Lunacy, but no one can be sure. If this story makes it to the pages of *73*, you will scoop *QST*, *CQ*, *Popular Communications*, and *Monitoring Times*.

George—Sure, whatcha got? However, if your "everyone knows" information about my "hates" is as accurate as your Waco information, it isn't going to be of much value . . . . Wayne

QRX . . .

Number 3 on your Feedback card

Reality Check

You have to wonder if it is more fitting to dignify false accusations by responding to them with the truth, or is it wiser to simply ignore them, to turn the other cheek? We offer this compromise: *Here is the issue of* 73 *that a certain few overzealous rumor-mongers said would never be printed!* And there will be many more issues to follow.

73 has been around for 34 years so far, and we feel our loyal supporters need to know we're here to stay. To those few who deliberately tried to put us out of business, and you know who you are; we hope you have a good lawyer.

73 Photo Search Finds Success

Dozens of the *73* faithful have blown the dust off their camera lenses and taken to the streets of hamdom in search of the perfect cover shot. We are certainly encouraged by the quality of the work being submitted in the *73 Photo Search*, and we'd like more of you to give it your best shot.

Our first amateur photo appeared on last month's cover. It won notoriety and fame for Jose Rivera KP4FMD, as well as a free year of *73* magazine! Jose and his wife Maria WP4FRO faxed our office when they saw their photo. "We could not believe our eyes when we saw our picture on the cover of your magazine. This was really a wonderful surprise," they wrote.

So what's holding you back? Suitable subjects would include ham radio equipment, amazing antenna arrays, or better yet, catchy ideas of your own.

Our format calls for a color photo which is: 1. Vertically oriented; 2. Sharply focussed; 3. Leaves extra room at the top and left side; and is 4. Not too busy. We prefer 35mm prints.

Send your color prints to *73 Photo Search, 70 Route 202 North, Peterborough, NH 03458.* Please include a brief description of your photograph, your full name and callsign, and your permission to publish. We cannot return photos without an appropriately-sized SASE. If we do not use your photo on the cover, perhaps we'll find a spot inside. We might even use it in our sister publication *Radio Fun*. Good luck and happy shooting!

FCC Slaps VEs, Cancels Upgrades

The Federal Communications Commission has begun proceedings against three suspended volunteer examiners and has downgraded fifty-one amateur licensees after an extensive fraud investigation in Southern California. According to the "Westlink Report," Extra Class Licensees James B. Williams AA6TC of Wilmington, CA; Robert L. Flores N6WPQ, and his wife Rose Marie Flores N6WPR of Santa Monica, CA were ordered to turn in their licenses. The FCC believes all three conspired to commit fraud in at least one instance in violation of the rules and regulations governing participation in the volunteer testing system.

The FCC has also acted to punish 51 hams who either refused to take retests or failed their new exams as part of the agancy's ongoing investigation. Investigators say at least one test session never actually took place. Indications are that this is just the tip of a very large iceberg, and more disciplinary actions by the FCC may be forthcoming. *TNX Westlink Report, No 682, October 13, 1994.*

Bye Bye BBS

The *73 BBS* has been dead for several weeks now. It apparently caught a virus and croaked before the ambulance arrived.

We're considering upgrading to a faster, more powerful, Macintosh system but nothing is definite yet. Surprisingly few people have noticed that the old BBS has been down. Does anyone care? If so, drop us a line. We'd like to hear from you.

73 Staffer Wins Ozzie

73's Graphics/Production Manager Linda Drew has been awarded a Silver Ozzie Award for Publication Design Excellence for her work on Wayne Green Inc.'s *"Cold Fusion"* magazine.

Winning the coveted Ozzie is a major achievement in the publishing world. Entries were considered from many of the best-designed publications in North America. Linda has been on the staff at Wayne Green Inc. since 1978 and we enjoy the benefits of her work every month. Good going, Linda!

Dial FCC Toll-Free

The Federal Communications Commission has installed a new toll-free telephone service at Gettysburg, Pennsylvania. The 800-number is now available for customer service inquiries at the licensing division.

The number is **(800) 322-1117** weekdays from 8 a.m. to 4:30 p.m. Eastern Time. It gives you access to an automated system which will record your requests for forms and records, complaints, and requests for information.

The commission instituted the new number after a presidential order that the federal government be "customer driven." The FCC conducted research to determine the need for the 800 line. Within the next year and a half, the FCC plans to institute other customer service improvements to comply with the White House directive. *TNX Florida Skip, Vol. 36, No 10, October, 1994.*

Ham's Project Takes Off

A New York amateur radio operator expects her scientific experiment to take off soon aboard an upcoming space shuttle flight. Dallna Steiner N2MIA is a researcher at the Hospital for Special Surgery in New York City. Her project is a study of cartilage mineralizing culture systems. This, she says, is crucial to the understanding and treatment of osteoperosis and other bone diseases.

Steiner recently spent a week at Cape Canaveral on a run-through with the NASA launch team. Her project is slated to fly aboard the Endeavour STS-66 by year's end. *TNX Westlink Report, No 682, October 13, 1994.*

Kid Power

Carole Perry WB2MGP is looking for good speakers under the age of 18 to be presenters at the Dayton '95 Youth Forum. Children should contact Carole for an interview. Her address is at the top of her column "Hams With Class" on page 60. Or phone Carole at (718) 983-1416.

Carole would also like to encourage adults to bring a child or young adult to the Hamvention. Support the future of ham radio!

DXpedition Needs a Hand

The South Georgia Island team of Al WA3YVN (VP8SSI), Jan WA4VQD, and Vince K5VT will operate for at least 15 days from South Georgia Island January 4-19, 1995. They will have three HF stations on all bands CW, SSB, and RTTY. They are well equipped for low band and new band operation.

The team will arrive in the Falklands on December 23, 1994, and will operate on the low bands and the new bands for about five days while awaiting the departure of the R/V Abel-J. This is the same ship that transported the VP8SSI team in 1992.

Donations are needed to support this DXpedition. For information contact SGI DXpeditions, P.O. Box 2235, Melbourne, FL 32902. QSL cards will be handled by INDEXA, c/o John Parrott W4FRU, P.O. Box 5127, Suffolk, VA 23435.

TNX . . .

. . . to all our contributors! You can reach us by phone at (603) 924-0058, or by mail at *73 Magazine*, 70 Route 202 North, Peterborough, NH 03458. Or you can FAX us at (603) 924-9327. News items not published in *73* often find their way into our sister publication, *Radio Fun*, a special monthly magazine for new hams. We welcome news and interesting photographs from the world of amateur radio.

Kit Builders' Primer

Yeah, I built that.

by Mike Bryce WB8VGE

Nothing brings a smile to my face faster than the smell of molten solder. In fact, I really enjoy building my own equipment. A Friday night, a 10-pound bag of Oreos, two cases of Diet Coke, a new PC board and whoa! An all-night building binge is underway! Throw in some CW coming from the ARK-40 with a dash of the *X-Files* running on the TV in the background and you have my idea of ham heaven. Even if the project I'm working on does not work when it's done, I still have fun building and then troubleshooting the circuit. And when I'm all done, I take a deep breath and say, *Ooooo, let's do it again!*

If you've never heated up a soldering iron before, this is the time to get going. In the past, many of the projects in magazines like *73*, *Radio Fun*, and *QST* required several parts orders to gather all the pieces parts together before solder touched copper. Now, there's a flock of people putting kits together for some of the more interesting projects.

Electronic kits are an easy way to start yourself on building your own ham gear. Usually all the necessary PC board components are supplied, as well as a PC board. Sometimes you can even get a nice-looking case to house your project in.

Hail to the Heath

Mention kits, and everyone thinks of Heathkit. They are still the standard by which every kit produced will be compared. That's saying a lot since Heathkit is no longer making electronic kits. What set Heathkit apart from everyone was their manuals. The manuals were clear, concise, with plenty of drawings at every step of assembly. It took a lot of labor and time to produce a manual for Heathkit.

Today's Kits

You won't see a Heathkit-type manual today, although some of the kits I've assembled are getting close. Many of the kits I've run across are known as *BOP*s. A BOP? Yup! A Baggie Of Parts. Throw in a sheet or two of instructions or guidelines, a PC board overlay, and there you go! A BOP kit usually makes the Friday-night building binge interesting.

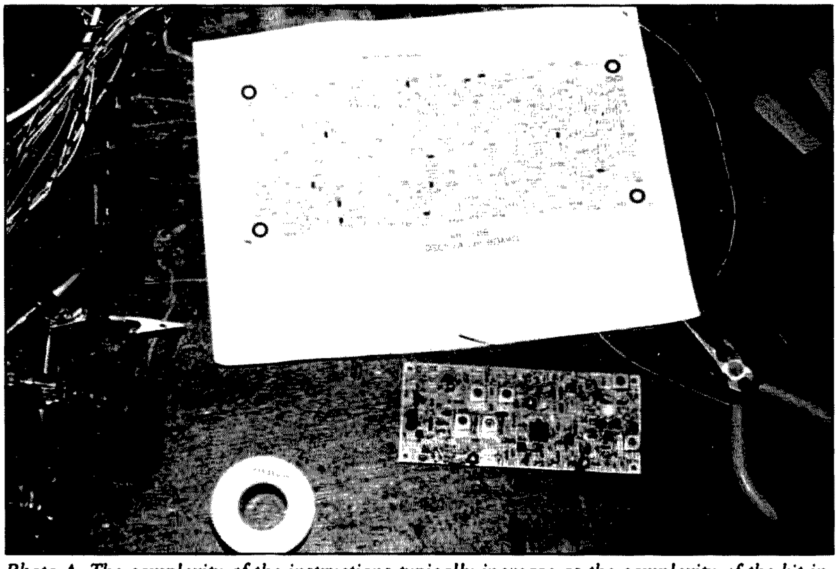


Photo A. The complexity of the instructions typically increase as the complexity of the kit increases. (Photo by Jeff Gold AC4HF.)

The Fine Art of Kit Building

Before you open up the kit, you need a place to work. Pick a place where you can let the kit just sit if need be. Don't use the family dining-room table. Besides the mess, a misplaced soldering iron will really cook a tabletop.

Next, the work area should be uncluttered. In my workshop, cleaning the top of the workbench is a job in itself—I know I could build a CAT scanner just from the parts laying around! There's nothing worse than finding an extra 6.2k resistor and not knowing if this part is for the kit or just laying around. A clean, well-lighted work area is a must-have for any kit building.

Most people will tell you to sort and count off all the parts in your kit against the parts list. I don't. To me that's a waste of time. You'll know if you're missing a part when you come to it.

While you're putting together your kit, you may find a part missing. I never panic, but simply mark on the overlay that a part is missing and continue on with the assembly. I've found in the past that the missing part shows up. Never, ever throw out any of the packing material that came with the kit. A missing diode or connector may be lurking inside a foam peanut.

I lay a sheet of paper down on the workbench, then place all the resistors in one pile, all the capacitors in another pile, and all the semiconductors in another. When a 10k resistor is called for, I wade though the pile until I find one. The paper adds contrast so you can see the color codes of the parts easier. It's especially helpful with resistor color codes. The paper will also reflect light up so you can read the markings on the diodes and transistors much easier. And, if you mislay a part, it is much easier to spot on the paper. Depending on the complexity of the kit and the amount of parts used, I take a pencil and mark the name of each pile on the paper. A small drawn arrow points to the correct pile of parts.

If the kit has some of the parts in small envelopes or bags, never open them up until that part is called for. This way, you'll never risk installing U3 instead of V3.

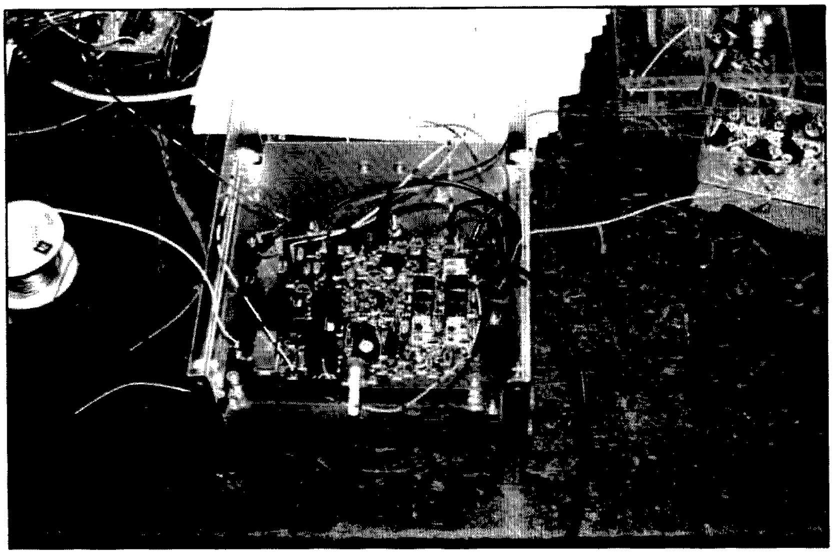


Photo B. Here we see the Oak Hills Classic QRP rig kit starting to take shape. Check out the review on page 14. (Photo by Jeff Gold AC4HF.)

Before any solder hits the PC board, I always look over the PC board for any signs of damage or under-etched copper. A tiny spot of copper between two pads is all it takes to cause trouble. When stuffing the PC board with parts, I make a mental note of the traces and pads. Pads that are supposed to be connected can look like a solder bridge. This way, I avoid the hassle of desoldering a good joint. Depending on the kit, a PC board foil pattern may be included. This really helps you to find and detect solder bridges as you assemble your kit.

Because there are so many resistors in any given circuit, they go on the PC board first. Just because the leads on resistors are long does not mean you have to use the whole lead. Unless directed otherwise, resistors mount flat against the PC board, and not up in the air an inch or two. The same goes for diodes and axial capacitors. Push them both down against the board. Although not really necessary, I like to place all the resistors with the color codes all pointing in one direction. It makes troubleshooting a bit easier if you don't have to constantly flip the PC board from side to side. Besides, a PC board is a piece of artwork!

I do the same for capacitors, too, as long as they are not polarity sensitive. By inserting the capacitor with the lettered side out, you can check your work much easier.

When installing diodes, resistors or axial capacitors, bend the leads slightly away from each other after you have passed their leads through the holes in the PC board. Don't bend the lead flush to the board—doing so will almost guarantee a solder bridge.

I mount IC sockets, trimmer capacitors and pots with one or two leads, check the mounting, and then solder in the remaining leads. Again, be sure you have everything down flush on the board.

Semiconductors are in a class by themselves. They must be installed the right way or the circuit won't work. There is also the possibility of toasting the semiconductor. I mount TO-92 style transistors about 1/4" above the board. This leaves me enough room to get a test probe on the leads, but short enough to prevent critters from developing because of excessive lead length.

Unless the instructions say otherwise, don't use IC sockets in circuits using high-speed or high-frequency ICs. The extra lead length will cause havoc with the circuit. Phase-locked loops are especially touchy about IC sockets. However, sockets are a good idea, especially when using a double-sided plated-through-hole PC board. If you have any doubts, a call to the kit's manufacturer should clear things up.

Take breaks. There's no rush, this is not a contest to see how fast you can assemble a circuit board. Kit building is supposed to be fun, not a race to see who gets done first. Take time out to rest your eyes.

I always leave a radio cooking in the background, listening for CQs. When I hear one, I roll my chair over to the rig, and with a bit of luck, I'll have a QSO. And, you'll have something to talk about besides "The rig here is Kenwood and the weather is warm!" If nothing else, get up and add some ice to the Diet Coke and grab another fistful of Oreos.

Surplus Parts and Parts Substitutions

You'll find a lot of surplus parts in kits. There's nothing wrong with the practice. Most of the surplus parts are prime number-one-grade components. Most are made for the military or consumer market. Surplus parts are usually better than the honest-to-goodness parts. This is especially true if you end up with mil-grade goodies.

Let's say our kit calls for a 2N2222 transistor. Instead, you find inside your kit a XCX345/SXC. What you got is a surplus NPN transistor made by who knows who. It will work in the kit. There's a good chance it was made for the military, costs the government (you and I) $34 each and now the military can't use this part anymore because of design changes. A parts broker purchased three tons of them and is selling them off for a dollar a pound. That's how you and I end up with surplus parts in those BOPs.

Surplus semiconductors are not bad, but surplus capacitors can be a real pooper! A 0.1 capacitor is a 0.1 capacitor for almost all projects. But if the PC board is laid out for a lead spacing of 0.2 inches and the surplus capacitor has 0.7 lead spacing, whoa! It's not going to fit! Just like a fat lady with a pair of tight jeans, with a lot of pushing, shoving, pulling, you can get the part to fit the board, but it's not going to be a pretty sight!

There may be a part or two that the kit supplier has substituted. There's no need to panic, as most substituted parts will cause no noticeable difference in the way the project performs. If the original article called for a 1.1 μF cap, and the kit has one that's 1.5 μF, that's just fine. As long as the working voltage of the capacitor is as high or higher than needed, you'll have no trouble. Most of the electrolytic capacitors have a working voltage of 16, 25, or 35 volts. Of course, there are many more values to pick from but these are the ones you'll see the most. If the schematic calls for 4.7 μF at 16 volts and your kit has 4.7 μF at 35 volts, that's just fine. Solder him in and move on to the next component. (I've found that active parts like transistors and ICs are female, resistors and capacitors are male.)

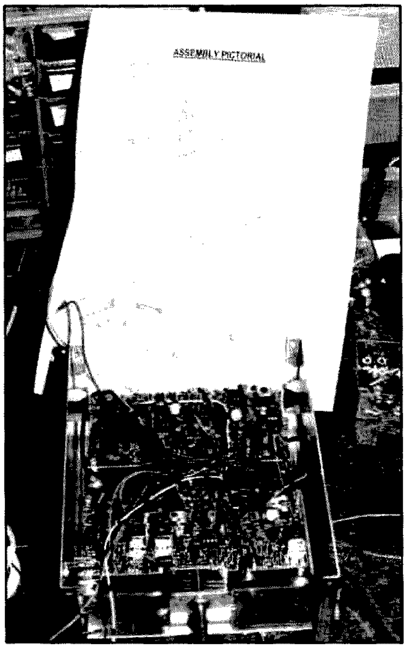


Photo C. You'll want to work in a comfortable location where you can leave the partially-assembled kit undisturbed. Don't use the kitchen table! (Photo by Jeff Gold AC4HF.)

Instructions and Manuals

BOP kits are not noted for their instructions. Most BOPs consist of a photocopy of the original article, a parts overlay for the PC board and a sheet or two of additional instructions. Most of the assembly work must be done by the builder! If the instructions say to "install the resistors," that's what you do. Usually, as the complexity of the project increases, so do the instructions—unless it's a Kanga kit. Then you're on your own!

Before you do any soldering, it's a good idea to look over the instructions of the kit and do a dry run through. Make a note to yourself of any part of the instructions you're not clear on. A good dose of common sense is your best weapon. If it sounds really stupid, it probably is. Double-check this step before you move on. I can look past most errors in a kit's instructions. If you're told to install an RCA jack on the PC board and there's no way it will fit, then there's an error in the instructions.

Locate the proper part and install it on the board. Make a note of the error on the instruction sheet.

Soldering

I've melted a lot of solder in my time. I think I'm fairly good at the task, but every now and then I screw up royally. Over 90 percent of the kits returned to Heath did not work because of poor soldering.

I use two different soldering irons for kit building: An 18-watt Antek iron for small work, and a larger 45-watt iron with a big tip for heavy-duty work for soldering in connectors and such. Keep a spool of desoldering braid handy to clean up any mistakes.

Don't try to cook the PC board with an iron that's not hot enough. Soldering is a lot like kissing your aunt—you have to be quick, do a good job, and leave no slobber. All your solder connections should be bright and shiny.

Troubleshooting

The odds are in your favor, but every now and then one of the kits I finish up with won't work. I start by looking at every solder joint. I especially check any odd-looking *clump* of pads for solder bridges.

If I find none, then I look at a misplaced resistor. It's so easy to put in a 470-ohm resistor in place of the 47k resistor. Equally useful, but hardly interchangeable! I check for like values, as in the example above, in case I have mistaken them during assembly. After I check the resistors, I move on and do the same for the capacitors. If I don't find any problems, I move on to the semiconductor, and so on until I'm sure there is no problem with the way the kit went together. Usually, the problem can be located and fixed without too much trouble.

Kit building is a lot of fun. For me, it's solder fume therapy, as I get totally involved with a kit. Why, who knows, maybe you'll soon be saying, "Ooooo, let's do it again!" ■

Number 5 on your Feedback card

The Oak Hills Classic

Dual-band QRP kit.

by Jeff M. Gold AC4HF and Daniel Wee

Oak Hills Research
20879 Madison Street
Big Rapids MI 49307
Telephone: (616) 796-0920,
FAX (616) 796-6633.
Price Class: Kit—$219.95;
Optional keyer—$39.95

I like to build all levels of projects, but sometimes I really like to sit back and just enjoy building up a project that I know will not have any surprises for me in the way of unclear directions, or directions filled with mistakes or poor performance of the kit when it is completed. I have built many of the Oak Hills' kits. I have enjoyed building every one and they all worked well when completed. Oak Hills takes great care in providing top quality parts and clear and easy-to-follow directions.

The Oak Hills Spirit that I built for 20 meters was one of my favorite rigs to build and operate. When I heard that Oak Hills was going to sell a kit that was designed as well as the Spirit and was a 20/40 meter rig, I got excited—I spend most of my time on 20 and 40 meter CW/QRP. Having one rig that I could build myself, that would operate on both bands, and would run off a gel cell really appealed to me.

The Parts

I usually build larger projects in stages. I open the parts for one section at a time and separate out the various types of parts. Then, for example, I will put all the resistors on a piece of paper labeled with their parts numbers and do the same for the rest of the parts. This helps me check to make sure all the parts are included and also helps avoid one of the biggest pitfalls in building: putting a part in the wrong place.

The parts for each section of the Classic are bagged separately. The boards are about the clearest silk-screening I have come across and they have plated-through holes. The back of the board is coated over to help avoid the second big pitfall of building kits: solder bridges. All the coils are pre-wound to help the kit go together quicker and avoid problems that many builders have with winding their own coils. The instructions are excellent; Oak Hills employed an illustrator who used to work for Heathkit. The case is nicely screened and is really good quality. After seeing how easy the kit looked to put together (the parts are fairly close together on the board, but this shouldn't present much of a problem), I decided to separate out the parts into little plastic parts bins and not take the time to label every part.

Assembly

My wife does beautiful needlepoint and other crafts of this type. I always ask her why she doesn't enter some of them in the County Fair. She says she can't do that because although they look great from the front, the back side of the work isn't perfect. This is the way I usually operate with my building. If I am building a lot of kits, the kits usually work well, but may not be the prettiest things you have ever seen. My goal for this project was to be able to enter it in the County Fair and have anyone look at the bottom of the board and say how pretty it was. I knew I was going to keep this rig for a long time if it worked the way I thought it would, so I decided to really take my time building it.

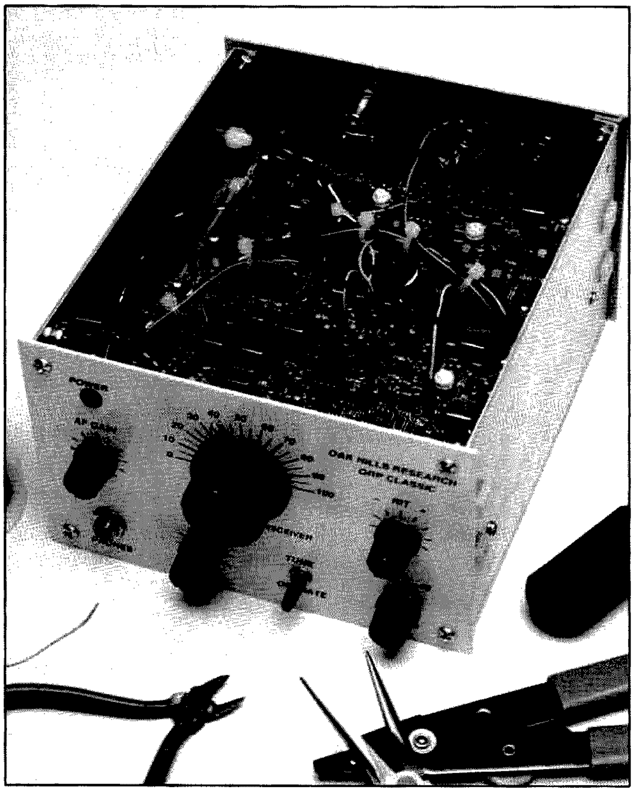
I found the kit went together very quickly, even though I really took my time. I had no problems with the directions and never found a case where the instructions were ambiguous. I would rather just have a parts overlay and schematic than ambiguous directions.

With the optional iambic keyer there are four printed circuit boards to build. There are separate boards for the oscillator, receiver, transmit/receive, and a small board for the keyer. Each section comes has separate bagged parts, and overlays, which makes the kit much easier to build.

Alignment

The alignment procedure was fairly straightforward and didn't take much time. It is recommended that you have a frequency counter to adjust the oscillators. Separate adjustments are made for the 20 and 40 meter band sections.

After I knew the rig was working well I went back and readjusted the coils in the oscillator section a little differently than the instructions called for. I found that following the instructions gave me the full bandwidth on both bands, but the analog meter that is silk-screened on the case was a little off. By readjusting the coils and playing with them I was able to get the rig so that the panel frequency indication was right on the money. This is one of the only rigs on which I have been able to get the reading to be accurate for the whole bandwidth. I would suggest that you follow



the alignment procedure first—you may find that it works out correctly for you if you follow the provided instructions.

Circuit and Design

The OHR Classic dual-bander is invariably one of the best receiver designs I have seen on the kit market. Part of the strength of the circuit lies in its use of extensive filtering in the front end and IF stages. The use of the diode-ring mixer (the TUF-1) also results in a good dynamic range and the receiver is essentially a low noise one.

Looking at the circuit, you will find that all the switching is solid-state, including the T-R switching. This is a good scheme and you won't hear any relays clattering away as you send code. All the switching diodes are biased at a common rail. Another area where diode-switching is employed in this circuit lies in the band-changing circuitry. Essentially, the band switch uses the diodes to switch in one of two band crystals for the LO and to switch in the appropriate band-pass filter. (It would have been nice if they had used hot-carrier diodes for this).

The circuit itself is a classical one (no pun Intended). It comes with an RF-preamplifier stage to provide some front-end gain to compensate for the filter insertion loss. This is a standard negative feedback broadband preamp and is unconditionally stable. The 2N5179 is also a low-noise device so that helps somewhat. The diode-ring mixer is then terminated in a diplexer and a post-mixer amplifier before going through the standard four-pole crystal ladder filter. The use of the MC1350 permits IF AGC, which is audio-derived.

The product detector uses an NE602AN, which seems to work fine at this stage (after the AGC) since overloading can be easily controlled, and provides some conversion gain (12 dB or so) as well.

There is an audio preamp stage before the audio is fed into a permanently wired audio bandpass filter. This is not a very narrow one and I suspect that its purpose Is to get rid of wideband IF noise products. Finally, there is an LM-380N-8 final audio amplifier which is under-driven for low THD figures.

The VFO/LO is built on a separate board which helps isolation and stability. It is well-buffered before being fed into the diode-ring mixer, but a drawback here is that the mixer injection signal is sometimes on the low side and is not constant for the two bands. LO signal levels should be +7 dBm (ballpark) for good performance. The problem here lies in the oscillator, which does not perform too well at the higher crystal frequency (18.000 MHz). Perhaps the MPF102 could be replaced with a 2N4416.

As you can see, this is a very straightforward design and its strength lies in the fact that OHR did not skimp on filtering and matching impedances.

The TX side of the board is cleverly designed to reuse the RX mixer section so there is no additional mixer for the TX side. Similarly, the bandpass filter for receive is also reused for transmit. A good scheme, really, and economical too. After the bandpass filtering there is a two-stage driver, which is essentially Class-A amplifiers, before the final Class-C amplifier (2SC2075). This is followed by the mandatory low-pass filter. The switching is all solid-state, of course, as I have mentioned before, and looks very well implemented.

Performance

The performance of the rig attests to the soundness of the design. My one gripe is the permanently fitted audio filter which is used to filter out wideband IF noise. I would have been much happier if this noise (6 dB) could be prevented in the first place, or to have some pre-product detector filtering. Ah, well, you just can't always have the cake and eat it as well, can you? A very good design and performer (as many will tell you), overall.

There are two aspects to every kit building experience. The first Is the building experience. With the Classic, this phase was a clear winner and rated at the very top of its class. The second aspect is how it performs. I have found that even with all the rigs I have hooked up on my operating bench, I end up using the Classic a lot. I really am impressed with the smooth solid-state QSK. I hate relay switching. I find that even though I really like my expensive Kenwood 850S, the relay QSK bothers me. I prefer the switching on the Classic a lot better. I find the receiver to be both sensitive, so that if the signal is out there—I am hearing it)—and selective—I am easily able to separate out signals except during the most crowded band conditions. I have also found the VFO to be stable. I don't like having to chase signals across the band while I am in the middle of a QSO.

The RIT has a center detent, which makes it easier to use. The tune/operate switch comes in real handy for me. I have a resonant quad for 20 meters, but find that on 40 my vertical needs an antenna tuner to get the SWR down. I find this a lot easier to use—having the tune switch so that I don't have to have a manual key to keep the rig keyed. I also like the fact that you can change the transmit power easily without having to take the cover off the rig. This makes it easy to experiment with different power levels. My rig puts out about 5 watts on 20 meters and about 7 watts on 40 meters. This means that you may have to use the rear panel power adjustment to keep the power level the same when you switch bands.

The keyer is the newer Curtis keyer chip and works very well. It is also very nice to have the straight key jack in addition to a jack for paddles. I often like to operate with straight keys and this rig needs no modifications to be able to do this.

The Classic uses an LM-380-based audio amplifier which is better than the LM-386. There is plenty of audio to drive headphones, but the rig doesn't have enough drive for a speaker. This is one of my only complaints. I don't like headphones except during Field Day, and would have liked to install a small speaker. My other complaint is that I find the rig a little on the large size for portable backpacking operations. I like to take a rig and a gel ceil on long hikes and would have preferred having a smaller rig. I really like the case for the rig and find It a little too pretty to throw in a backpack, so it would have to wait for a while anyway. There is plenty of space inside the case to add custom accessories, such as a digital display or a speaker (with some additional amplification).

On the air is where the rig really shines. This transceiver is good enough to make quality contacts. since my first contact on the rig I have continually received good signal reports. This first contact was during a contest, with PI4COM in the Netherlands. He was a 599 with high power and my signal report was a 564 with 4 watts. I next talked to Marty KW1C in Maine. He reported "your new rig doing FB." Next, I had a nice long QSO with Gary WBØDBW/AE in Columbia, Missouri. It was his first contact with his new Extra Class license. We had a nice long QSO. He said the rig sounded great on his end. I have since had many long QSOs, both US and DX, and have worked some contests with the rig. One of the highlights of testing the Classic was having a sked set with Ted VA3TAR. The Classic was Ted's first kit. We arranged to meet on 40 meters. Even though conditions were poor, we had a great conversation. It was exciting to hear what the rig sounds like over the air in actual use. The rig sounded great. I think this attests to both the quality of the kit and its design. I really enjoy operating this rig, especially since it covers my two favorite bands.

Features: The Oak Hills Classic Dual-Band Transceiver Kit for the 20M and 40M Bands

Superhet receiver design with diode ring mixer and RF preamp.
High side LO injection on both bands for a cleaner signal.
Four-pole crystal ladder filter.
Four-pole audio filter.
AGC circuit.
VFO tuning with 8:1 vernier dial covering 100 kHz on both bands.
RIT with center detent control providing +/-1 kHz.
Sidetone oscillator with level control.
Smooth solid-state QSK.
4-6 watts of RF power on both bands.
TX power adjustable from 0 to full power on rear panel.
Both iambic and manual key jacks provided.
12 VDC operation—current drain 290 mA on RX and 1.2 A on TX.
Measurements: 4" x 6-1/4" x 6-7/8".
Weight: 48 oz.
100% complete, all coils prewound.
All panels prepunched for optional iambic keyer.

73 Review

Number 6 on your Feedback card

by Michael Bryce WB8VGE

S & S Engineering's ARK-4

A 40 meter transceiver kit.

S & S Engineering
14102 Brown Road
Smithsburg MD 21783
Telephone: (301) 416-0661; Fax (301) 416-0963
Price Class: $199.95 kit; $269.95 assembled and tested.

Some of the buzzwords in today's politically correct world are "smaller," "faster," "cheaper" and "better." Well, that's exactly what S & S Engineering created when they introduced their new ARK-4 40 meter transceiver kit.

The ARK-4 is a fully synthesized QRP transceiver for 40 meters. It's a CW-only rig; there is no SSB on the ARK-4. But, you do get full QSK break-in keying and the 40 meter CW band. It's ideal for the Novice ham, too. In fact, it's one of the few rigs in kit form I'd recommend for a Novice. Thanks to its fully synthesized transmitter, the Novice operator will know exactly where he or she is. This is very important to Novices, who have only a small slice of the 40 meter CW band to begin with.

The ARK-4 comes in a wide variety of configurations. Depending on your budget, you can get just the transmitter or the receiver components with the kit. Later on, as your budget allows, you can add on the goodies until you have a complete 40 meter rig. Why, you can even install a Curtis-based keyer inside your ARK-4. And, if you just can't stand the smell of molten solder, the ARK-4 comes assembled, tuned and tested. Most people will find building the kit the way to go.

If you plan on building the kit, and I hope you do, this is one of the few kits I'd say a beginner can handle. Yes, there are hundreds of parts in the ARK-4. Yes, there is a double-sided plated through-hole PC board. But, you build the ARK-4 in steps, checking each section as you go to make sure you've assembled it correctly. The assembly manual is quite extensive and offers tips on soldering and proper placement of components, and features several large fold-out sheets. And if that is not enough, provided you assembled the ARK-4 in good faith, you can always get the ARK-4 repaired. There's no reason why a beginner in home-brew should not consider the ARK-4 as their first kit.

A Look Inside

The ARK-4 is really a departure from most of the QRP rigs I've built. When you slide the rig out of its TNC-style cabinet, you'll notice there are no wires of any kind inside. Yup! You read that correctly: There are no wires inside the ARK-4. Every part mounts on one double-sided PC board. I know, I've always disliked making up my own interconnection wiring harness. No wiring harness means fewer mistakes during assembly.

There are no mounting screws holding the PC board down, either. The PC board slides inside the case. The end caps of the case hold everything together. You can open up and inspect the ARK-4 in a matter of seconds!

The signal path is very much like that of the ARK-4's bigger brother, the ARK-40. There's a slight difference in the way the signal is handled in the IF stage: The IF frequency of the ARK-4 is based on a crystal filter made up of color-burst crystals. This is also the reason why you won't be seeing an ARK-2 or ARK-3.

The synthesizer and a PLL make up the heart of the ARK-4. I won't get into the details of how they both work together, as this is very clearly explained in the manual. It's must reading for the builder as it makes the operation of the PLL and translation oscillators very clear.

The manual that comes with the ARK-4 is different from what you may have seen in the past. Whatever features you purchase with your ARK-4 will shape the size of the manual. The manual has a pull-apart binding to allow you to add pages of assembly text as you order options for your ARK-4. For example, if you only order the transmitter, that's all the instructions you'll receive. Order the transceiver and you'll get transmitter and receiver text.

Although I did not have the pleasure of building this kit, the kits I have built in the past from S & S Engineering are first class. Only the best prime components are used in the kits; there are no surplus or *hamfest special* parts used.

On the Air with the ARK-4

There's not much to do to put the ARK-4 on the air. All you need is a power supply capable of 3 amps, an antenna, and a key. The front panel is nicely laid out, with all the important controls centered. There's the usual on-off volume control, RIT, and transmitter fine-tune control. The options you order for your ARK-4 will determine the amount of control you have over the rig.

Just like the ARK-40, you tune the ARK-4 by push-buttons. However, in the case of the ARK-4 you can use the fine-tune control to put your transmitter exactly were you want it. The fine-tune control is *not* the RIT—that's a separate control on the ARK-4. I found the best way for me to tune the rig was to set the frequency control buttons to one location and use the fine-tune control to hunt for stations. When a station answers me, I then use the RIT to center him in the middle of the crystal filter. This is how I used the ARK-4 during Field Day, with very good results. I worked just about everything I could hear while using a center-

fed Zepp at 25 feet. A 24 amp/hr. gelled battery provide the power. After the weekend, the battery seemed untouched.

The ARK-4 does not have enough audio to drive a speaker. It's a headphones-only rig. You can use an amplified speaker if you want. Radio Shack sells an amplified speaker for about $20. I also found out that the audio output stage of the ARK-4 is very sensitive to the kind of headphones you attach to it. I used a pair of "walkthing" phones and had so-so results. Later on I changed over to a pair of mono headphones from Radio Shack. These worked better, but I still found the audio to be a bit fuzzy. I measured the impedance of the headphones and discovered they were about 16 ohms for the pair and 32 ohms for each earpiece. I finally hooked up my old 8-ohm Telex 'phones and had much better-sounding audio. I also got a much nicer sidetone when using the telex phones. You may have to play around to find the proper set of headphones for your ARK-4 as well. However, I must add that the rig I was using was one of the first prototypes made by S & S Engineering.

My review unit also came with a built-in audio filter. This filter really improves reception when the QRM is running high, although I found the CW bandwidth just about right for me without the audio filter. I must mention, however, that I never was one for super-tight bandwidth when it comes to my receivers. I like to hear those HW-7 users calling me off frequency by a kHz or so. You'll never work 'em if you can't hear 'em.

With no antenna connected, you'll notice a high-pitched tone in the audio. The tone all but vanishes when you attach your antenna. I also noticed the sidetone in the background. This is because the sidetone runs continuously and the T/R logic gates it on and off as needed. Again, once you connect an antenna up, you'll not notice the sidetone in the background. I did find that the sidetone changed levels, depending on the type of phones you connect to the ARK-4. In fact, when I attached my Telex phones, I found the sidetone to be way too loud for me. There is no internal sidetone level adjustment, although you can change resistor values to reduce the sidetone level to suit your liking.

The AGC action is very smooth, with no popping or pumping that I could detect. The AGC time constant seems *just about right* for the way I operate CW. You can also listen in on the VEs on SSB without much trouble.

The Transmitter

The ARK-4 provides a healthy 3 watts of output on 40 meters. That's more than enough to work the world, without killing your battery pack in the outback. The review rig produced a tad more than 4 watts into a 50-ohm load at 13.8 volts, a bit over 3 watts RF at 12.6 volts.

With full QSK, the ARK-4 provides for some exciting fun on CW. The relay used for antenna switching is loud. You can hear the relay clicking in time with your keying. With a slide-on cabinet in place, you won't notice the relay as much.

The ARK-4 is not as robust as its bigger brother, but I'm sure the ARK-4 would hold up quite well in the field. I'm not sure I would take it white-water rafting, but for casual hamming at your campsite it's going to be a hard act to follow. It would be just my luck to stumble upon Elvis and Bigfoot playing cards at a UFO landing, with the Loch Ness monster swimming past in the background, and not have a radio in my backpack!

It's an ideal rig for a hamvacation! Of course, my idea of roughing it is staying at a Holiday Inn while their restaurant is being remodeled. The ARK-4 will fit quite nicely inside a briefcase. Throw in a battery pack and you're on the air from your hotel room. Thanks to the synthesized frequency control, making that schedule with your buddy is no problem.

Last Word

I feel the ARK-4 will provide the ham with a better-than-basic QRP transceiver. You get frequency control that is unmatched by anything on the QRP market. That's a real plus on today's crowded bands. Was there a downside to the ARK-4? Yup! I had to send it back! Yes, I do believe that the S & S Engineering ARK-4 is politically correct. It's faster, smaller, cheaper, and better.

73 Review

Number 7 on your Feedback card

by Larry Antonuk WB9RRT

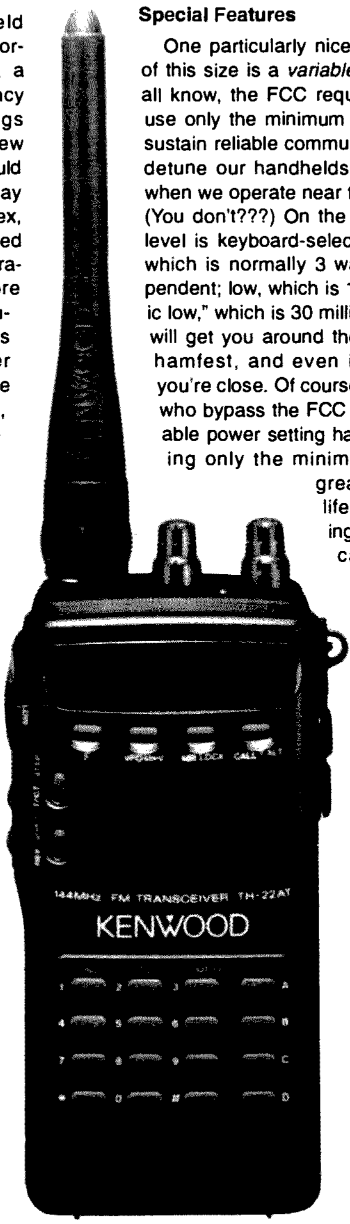
Kenwood Communications Corporation
Amateur Radio Products Group
2201 E. Dominguez Street
Long Beach CA 90801-5745
Telephone: (310) 639-4200
Price Class: $349.95

Kenwood TH-22AT Hand-Held Transceiver

Meet the latest in little HTs from Kenwood.

Running a 2 meter handheld used to be a pretty straightforward affair—on/off, volume, a squelch control, and a frequency switch. Of course, when things were synthesized we got a few more buttons, but all in all we could figure it out with a little time to play around. Things got more complex, however, as manufacturers packed even more features into every radio. Of course, that meant more buttons and knobs. Once manufacturers noticed that most hams had above-average consumer electronics skills (after all, we could program our own VCRs), high-tech radios appeared everywhere. This increase in the number of features came at the same time as a change in size—electronics were getting smaller. This shrinking meant that fancier features were coming in smaller and smaller packages. If you remove the battery and antenna from this radio you'll find that it weighs just two ounces more than the instruction manual. Where will it all end?

A grand finale may be the Kenwood TH-22AT. This hand-held radio fits right into the current trend. It's small—about the size of a mobile mike—and it performs a range of neat tricks. At first glance, the radio fills the bill of a general-purpose 2 meter handheld with all the usual specs. It puts out 3 watts with the standard battery pack in the normal mode, uses a dual conversion receiver with 0.16 µV sensitivity, and offers 200 mW of audio output. The fun starts beyond the solid basics, where the neat features begin.



Special Features

One particularly nice function for a radio of this size is a *variable power level*. As we all know, the FCC requires that we always use only the minimum power level that will sustain reliable communications. Most of us detune our handhelds to lower the power when we operate near the repeater location. (You don't???) On the TH-22AT, the power level is keyboard-selectable to high power, which is normally 3 watts and battery dependent; low, which is 1/2 watt; or "economic low," which is 30 milliwatts. Fifty milliwatts will get you around the house, around the hamfest, and even into the repeater if you're close. Of course, for those scofflaws who bypass the FCC regulations, the variable power setting has a side benefit: Using only the minimum power required greatly extends battery life. It's always surprising to see how far you can get on the low power settings!

Once you get over that kilowatt mentality and use the QRP settings, you might want to kick in the *battery saver*. This special function lets the radio sleep if it doesn't hear anything for five seconds. While not usable when scanning, a combination of battery saver and low power operation could wring a lot of use out of a single battery charge. In addition to the battery saver, the radio offers an *automatic power off* feature. The radio shuts itself off after an hour of no keystrokes.

The TH-22AT offers transmit features that are similar to those found on commercial two-way units. A *time-out timer* is available with periods of 30 seconds all the way up to 900 seconds—for serious one-sided conversations. Time-out timers can be particularly useful if that TNC you bought at the flea market is stuck in PTT—you won't tie up the channel while figuring out what's wrong. A *busy channel lock-out* feature prevents you from doubling with someone—the radio won't transmit if it hears activity on the channel. It would also prevent jamming, but it does need to be enabled by a responsible operator first. The entire transmitter can also be *disabled*—a good feature to have when you loan the handheld to an unlicensed friend. If you don't want to bother with frequency displays or you want to make things easier during emergency drills, the *channel display function* lets the display be configured to show only channel numbers rather than frequencies.

Memory functions allow a total of 40 channels—each with its own split, PL tone, dual-tone squelch codes, and more. Non-standard offsets can be programmed in addition to the usual +/-600. A *call channel* can also be entered—easily recalled with the tap of a button, it's also used in some scan functions. The call channel will probably be used to store your "home" repeater. The *DTMF keypad* allows telephone patch or repeater controller operation with five memory locations for storing frequently used calls. Up to 15 digits may be stored in a single memory location.

The TH-22AT offers a variety of *subaudible tone* and *paging functions*. The subaudible CTCSS functions are usable only with the optional TSU-8 decoder. They are similar to what one would find in the commercial market. On transmit, using one of the 38 standard CTCSS, or "PL," tones allows the operator to access tone-operated repeaters. On the receive side, however, the TH-22AT lets you enable *tone-coded squelch*. This is a feature that allows the receiver to remain muted until it hears the proper tone on the

carrier. It is used mainly in shared repeater operations in the commercial world so that you don't have to listen to other fleets on the repeater. It could be useful in ham radio as a way to avoid listening to anyone until your buddy calls with the right tone. Either of the PL functions is easily enabled from the keypad on a per-channel basis.

The Kenwood also offers a *dual-tone squelch system.* This is a receive-only function that uses a three-digit DTMF code to unmute the receiver. This feature provides a total of 1,000 discrete addresses, and it supports selective paging of specific subgroups. There is another advantage of DTSS over CTCSS for selective paging—DTMF tones will be easily passed over a repeater. CTCSS tones may or may not be retransmitted.

Taking yet another step, Kenwood offers *page operation.* This is similar to *dual-tone squelch system,* but with "Caller ID" added. When paged, the DTMF code of the calling station will appear on the display. In other words, if you're not right at the radio when the page comes in, the display will tell you who paged you and whether it was an individual or a group call. Page operation allows eight codes to be stored for ease of use—two for the system use and six for your convenience. With some imagination, a local repeater group can work out a series of emergency plans that would allow different groups and subgroups to be paged at will. Since the page mode uses DTMF tones, the system supports existing equipment, and also radios other than Kenwood's. Hams will use this feature primarily for selective calling between buddies. It's a great feature to have built right into the handheld.

Any of the above features can be used in conjunction with *tone alert,* which adds a beep tone when the radio receives any of the above tone sequences. Once the unit is paged, the radio starts beeping and a 100-minute timer starts. The timer resets itself after 100 minutes or each time a new page is received.

Scan Functions

Perhaps one of the most used features of a handheld in this class is the *Scan function.* The receiver in the TH-22AT covers 136 to 174 MHz. Most hams will probably have a police frequency or two plugged into a memory slot. (No, you can't transmit on 155.250, even if you do know something relevant to the conversation.) As per most features on this versatile radio, there are several options to choose between. To begin with, there are four basic types of scan:

Memory scan scans those channels in the memory list that you've designated as scan channels.

VFO scan scans VFO limits and lets you easily change directions with the channel select control.

Call/VFO scan lets you monitor the call channel plus any single VFO frequency.

Call/memory scan lets you monitor the call channel plus the last memory channel used.

The *call channel* is usually your "home" repeater, so either of the last two modes would be useful during a public service event. You could monitor the event frequency and the local repeater—or perhaps the event frequency and the local police department—at the touch of a button. Once you have determined the type of scan you need, you also need to select either time-operated or carrier-operated scan. Time-operated scan puts the radio in the "channel surfing" mode: scan along until you hear a QSO, listen, wait five seconds, scan some more, listen, wait five seconds, and so on. Five seconds may be too short to determine if you have any interest in a QSO, but this time length is fixed.

Alternativly, carrier-operated scan is the basic home scanner mode: Scan along until you hear a QSO and listen to it until they finish talking, even if this means listening to it forever. Both systems have their downsides, but the system you choose will depend on the personality of your local radio universe.

Startup and Operation

One of the classic tests of a product of this type is to see how far the operator can get without resorting to the manual. In the case of the feature-filled TH-22AT, the answer is—not all that far. Most of the obvious functions are easily accessible: The radio can be easily put on channel for a QSO. But some of the more advanced features are stumpers.

The reason for the difficulty is mainly that Kenwood decided to use very few buttons to perform a lot of tasks. Not counting the usual buttons like the DTMF pad and PTT button, the radio uses just six buttons to perform all of the other features. With just three different ways to push a button, the Kenwood engineers squeezed quite a few functions out of their options. The three possible modes for a button on a radio are: 1) just push it; 2) push it for an extended time; and 3) push it in combination with another button. The TH-22AT makes use of all three modes.

The display is also somewhat challenging. It doesn't provide much direction to the user when entering some of these functions. For example, say you'd like to lock out a member of the scan list. This would be handy if you had your normal scan list in the radio, but it kept stopping on these same two guys on the local repeater. The scan lock-out feature lets you leave the channel in its normal memory location and mark it as a channel to be skipped during the scan process. (You know, sort of like hitting LOCKOUT on your scanner.) On the TH-22AT, you simply: 1) tap the MR/LOCK button; 2) hold the F button down for more than one second; and 3) tap the LAMP button. Voilà! The channel is locked out. A small star pops up on the display under any locked out channels. The only problem with this is that neither the MR/LOCK (memory recall/keyboard lock), nor the F (function), nor the LAMP (display backlight) buttons are labeled in any manner that would hint at scan functions, let alone scan lock out. The solution is to practice and use the radio. You can memorize all of the keystrokes, or carry the five-page "Quick Reference Guide" found in the back of the manual. It seems like only a matter of time before some aftermarket vendor will start selling tiny plastic keyboard overlays, just like you get for WordPerfect, so we can figure out how to use our radios without lugging the book along.

In addition to the basic day-to-day features, the Kenwood TH-22AT also has a separate menu system accessible through a "hold the button while turning on the radio" mode. This allows access to the lesser-used functions, such as the *time-out-timer delay, transmit inhibit,* and *battery saver.* Once again, you may need the book. All things considered, the user is much better off having access to all of the functions available through these tricky key combinations, compared with no access at all. Could it be we're just spoiled by being able to hit the F1 key for context-sensitive help whenever we feel like it?

The Manual

The operator's manual, even though loaded with button combinations, is actually very well written. Everything is very clear and concise, and there are several sections devoted to ensuring a successful session with the radio—especially for the inexperienced operator. One section, "Your First QSO," gives just the basic steps necessary to fire the rig up enough to kerchunk the local repeater. A "Packet Operation" section gives hints on TNC hookup. The "Troubleshooting" section offers some help for possible problems. Not just the usual "check the battery if it doesn't work" type of advice, the list of symptoms consists of possible ways that the operator might inadvertently confuse the radio. For instance, you're in the PAGE mode, or the CTCSS mode, and you can't hear anything. You've accidently locked the keyboard and none of the buttons work. The list of symptoms addresses both common and uncommon problems, and their solutions.

The manual is suitable for all levels of users, and seems to be written with the beginner in mind. At some points the explicit instructions can be amusing: "If an abnormal odor or smoke is detected coming from the transceiver, turn OFF the power immediately. Contact a KENWOOD service station or your dealer." Good advice. Or how about "Functions requiring the keypad cannot be used if no keypad is installed." Most of the manual is not quite this carefully worded, and most necessary information is easy to locate with the very complete table of contents.

The Kenwood TH-22AT fills a very important niche. Small enough to be easily carried in a coat pocket, the unit has all the power and more features than many much larger units. Use it often enough to get used to all the different commands—or carry a handy cheat-sheet in your wallet—and the Kenwood will make a very talented and versatile day-to-day companion.

73 Review

Number 8 on your Feedback card

by Dave Martin W6KOW

Ameritron
116 Willow Road
Starkville MS 39759
Telephone: (601) 323-8211
Fax: (601) 323-6551
Price Class: $799;
High-band kit—$29.95

Ameritron ALS-500M Solid-State Mobile HF Amplifier

The long-awaited linear lives up to its promotion.

Kicking and screaming—after 40 years of hamming while managing to avoid owning an HF amplifier—I recently bought an Ameritron ALS-500M linear designed for mobiling . . . and I'm delighted with the purchase. Details follow, but first, for hams with similar leanings, the sequence that led me to the ALS-500M might be worth revealing.

I Like Low Power

Maybe it's the thought of sticking it to the power conglomerates or of getting the most kick for the buck, but I'm the guy whose first solo was in a glider, not an airplane . . . who bought a sailboat, not a power boat, when living in a yachting paradise . . . and who designed a little voltage-divider network so my Icom 735 could get *under* the 8-watt power control minimum for less-than-5-watts QRP.

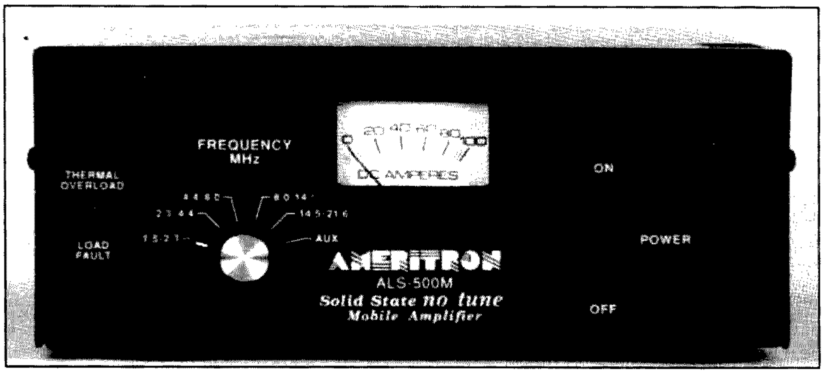
But circumstances change. About a year ago I joined a net scattered all over the country, and my linear-less shack and mobile rig condemned my 100-watt signal to the bottom of the heap; everyone else had power available to combat the latest decline of HF propagation that we can blame on the nadir of the current sunspot cycle.

Everybody recommends maximizing antennas before buying an amplifier, and I did. But there's not much chance of significant gain from a vertical whip on a small car. And my tiny California city lot—blessed with power lines on two sides and many nearby neighbors—pretty well precludes adding to the HF antenna farm, which includes a three-band, three-element yagi at 40 feet; a seven-band vertical on the house; and an inverted V fed with ladder wire.

Because of my long commute, a mobile amplifier seemed most desirable, but the home QTH signal could use a boost too. What to do? The idea came from a friend who travels between homes in Southern California and Montana: He runs a mobile linear in the car and uses the same box in his summer house, powered with a hefty 12V marine battery and an automatic battery charger.

The Order

After months of vacillating (and checking on the back-order status of the Ameritron ALS-500M at various ham stores), I ordered from the outfit with the fewest units on back-order. No strings were pulled; no mention was made of writing a review on this unit. Less than a week later, a large box appeared on the front stoop, and a quick trip to a near-by automotive store for a 108-ampere/hour, deep-discharge marine battery and a 10-amp automatic charger had the new rig on the air that day.



Initial Reports

The results were gratifying: First contact was with a station in Florida on 20 meters. He reported a barely readable S2 signal barefoot . . . and a plainly legible S7 with the Ameritron cooking. I know the numbers defy the laws of physics (indicating his S-meter calibration is off); using 50 watts barefoot and assuming peaks of 500 watts powered up, that's 10 dB of gain, which is just under two S-units, not five. But the importance is *readability*, which improved from *marginal* to *easily copyable*. QSOs over the next few days—while I waited for a second power plug from Ameritron to finish the mobile setup—confirmed a 2-S-unit improvement and a lot more punch through the reluctant ionosphere and QRM. That's why people spend hundreds of dollars on these things.

The Technical Side

The Ameritron ALS-500M is a compact (3.75" x 9" x 15"), light (7.5 pounds), solid-state HF linear with continuous no-tune coverage from 1.5 to 22 MHz (and to 30 MHz with presentation of an appropriate license and purchase of the $29.95 extender kit). Four 2SC2878 power transistors provide output of 500 watts PEP on SSB and 400 watts on CW. My measurements indicated full peak power was available with 60 watts of drive. Ameritron warns not to drive the ALS-500M with more than 100 watts continuously. DC power required for full output is 13.8V at 80 amperes on peaks. More on this shortly.

Load fault protection disables the amplifier if too much power is reflected from an antenna with high SWR (more than 2:1). An LED lights if this occurs. So far, I am operating without the benefit of a tuner in the antenna circuits, both mobile and fixed, and the Load Fault LED has remained off.

Thermal overload also disables the amplifier, and an LED warns when this happens. The unit operates cool and silently; a heat-triggered 3" fan that sucks air through a 6" x

6" heat sink and then the rest of the chassis comes on after a few minutes of transmitting. It is almost silent. Following a long transmission, the fan on my unit turns off a few seconds after unkeying the transmitter.

Push-pull circuitry and a multiple-section output network provide harmonic suppression, and listeners report the ALS-500M signal is clean and sharp. A relay control cable from the transceiver keys the amplifier. There is no ALC input to the ALS-500M. An additional low-power positive lead allows turning the amplifier on and off with an SPST switch that you supply and position where it's convenient, such as near the driver's position in a mobile setup.

Included in the package is an eight-foot power cable complete with fuses and a pair of No. 10 positive-side leads and a big power plug. If your installation needs more than eight feet of power lead, you'll need to substitute larger wire. For the 11-foot path from my car battery, I opted for two No. 8 positive-side cables. (One negative battery cable and connection to the vehicle chassis is used for the return circuit.)

Powering Up

A Bird Model 43 wattmeter and 50-ohm dummy load were used to measure the key-down power, both in the shack and in the car. In both cases, my power supply (10-amp charger and 35-amp alternator respectively) was unable to maintain the voltage to the amplifier at the rated 13.8 volts for more than a second or so; in a few seconds, voltage dropped to around 12V with steady keydown. When talking in SSB mode, the voltage drop takes longer, but it occurs.

Using 100 watts of drive power, sustained CW power of 480 watts at 3.6 MHz down to 300 watts on 21.2 MHz was measured. Except for 15 meters, these levels are above the 400 watts specified by Ameritron, which also notes that power will vary with frequency. An alternator large enough to maintain voltage above 12 V would result in more output—certainly at or above the power specified by Ameritron.

On-air tests in SSB indicate that my unit sounds best when driven by about 65 watts. Therefore, I measured power also at the 50-watt level and noted key-down CW levels of 440 watts at 3.6 MHz down to 250 watts at 21.2 MHz. These power readings were achieved at the sustained 12-volt input level.

Mobiling It

Hookup for mobile operation once the $10 power plug arrived from Ameritron consumed only part of an evening, as I had already made the cable. Coax to the base of the Hustler mobile antenna was changed from RG-58 to best-quality RG-8. An audio cable with RCA plugs on both ends was hooked from the RELAY jack on the Kenwood TS-50S transceiver to the ALS-500M, and RG-58 runs from the rig to the amplifier. The amplifier sits on the rear deck of my hatchback car where I can reach the switch and glance at the meter, so the remote amplifier feature is not used.

First tests on the road were as gratifying as at the home shack. Stations that could barely hear me on 100-watt barefoot power reported consistent Q-5 copy. My friend up the California coast who rarely hears my ground-wave signal on 20 meters reports consistent copy with the ALS-500M cooking. So far, everybody has reported excellent audio.

Back and Forth

If I dawdle, it takes about 30 seconds to remove or install the ALS-500M in either the shack or the car. My commute three or four days per week may become the test case for the durability of the amplifier's power jack and plugs. Maybe I'll install a handle on this 7.5-pound portable power package. Moving it between rigs is definitely worth the trouble.

In Summary

The voltage drop to 12 volts and resulting power reduction in my setup do not appear detrimental to the effectiveness of Ameritron's solid-state ALS-500M mobile amplifier. Everyone reports excellent audio and greatly improved readability in today's often-marginal conditions. That's what counts.

Stretched Vertical Gain Antenna for 6 Meters

Here's a way to dramatically improve your 50 MHz operating capabilities.

by John Sehring WB2EQG

At one time I lived in a rather deep valley and wanted to increase my operating range on 6m FM simplex (52.525 MHz), as well as use repeaters scattered over a 100-mile radius. So I was looking for an omnidirectional, vertically polarized antenna with as much gain as possible.

Because of the surrounding terrain, I could barely work stations only 20 miles away in some directions when using a 1/4-wavelength ground-plane antenna mounted about 25 feet off the ground. Many signals from not very far away were weak, had lots of QSB, and sometimes sounded distorted on FM.

The QSB and signal distortion was due to signals coming in from a variety of directions (multipath propagation) because of knife edge diffraction and various kinds of reflections and scattering over the surrounding hills.[1]

Omnidirectional Gain

With a unidirectional antenna such as a yagi, gain is achieved by concentrating the antenna's main lobe in both the azimuth (horizontal) and elevation (vertical) axes. However with an omnidirectional antenna, we can't compress the beamwidth in azimuth because we want to keep it non-directional.

The only way to achieve gain in this case is to narrow the antenna's pattern in elevation (the vertical direction). The lobe is then (usually) concentrated at as low an elevation angle as possible. The resulting radiation pattern looks like a squashed doughnut.

However, this would place the maximum gain lobe at the horizon (0 degree elevation) which would run it right into the hills around my QTH. Looking at the elevated visible horizon at my location, I wondered how much this kind of gain would help. But, I decided to give it a try.

So I put together a 1/2-wavelength vertical antenna to replace the 1/4-wavelength ground-plane I'd been using. I used a discarded 11m Citizen's Band 1/2-wavelength vertical antenna for materials (there are a lot of these around not being used!), including the insulated base and mounting bracket. Since the end of a 1/2-wavelength dipole is "hot" (a point of high impedance and therefore high RF voltage), it needs to be well insulated from ground. I installed four 1/4-wavelength radials (each 51 inches long and 1/2" in diameter) at the base of the antenna underneath the matching section.

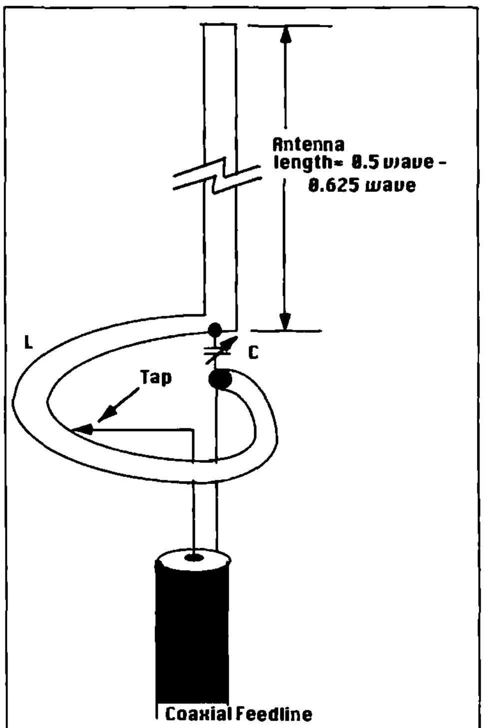


Figure 1. LC matching network for the Stretched Vertical Gain Antenna.

Matching Network

To end-feed the antenna I used a large, single-turn, tapped LC matching network at its bottom end (see Figure 1).[2,3] This network transforms the high impedance of the dipole's end down to 52 ohms.

It also puts the antenna at DC ground. This is electrically safer, and it eliminates precipitation static, which can be very strong (from blowing dust or snow, for example). These particles sometimes have an electrical charge. When they hit an antenna, they are discharged. If the element is not DC-grounded (as with a 1/4-wavelength ground-plane or a center-fed 1/2 wavelength antenna), the discharge must flow through the input circuit of the receiver, thus generating noise.

The loop (L) and tap are made from soft, eight-gauge aluminum ground wire, which is easy to form. The loop is about 7" in diameter, giving an inductance of around 0.6 µH. For the capacitor (C) I used a short piece of RG-58 coaxial cable. This cable has a capacitance of about 28 pF per foot. I cut it a bit at a time to get the right amount of capacitance. It required about five inches of cable (about 12 pF) to resonate the network at 52.525 MHz.

You could use a fixed or variable capacitor instead—but watch the voltage rating! The impedance at the end of a dipole is several thousand ohms, which means high RF voltage. Additional stray capacitance is supplied by the base bracket.

Rule of thumb: The inductance of the coil should be chosen to resonate the network at the operating frequency with a capacitor whose value (in pF) is from two to four times the operating wavelength in meters. This gives a sufficiently "high-C" (low loss) network.

I played with the length of the antenna (about 108 inches) to get it to resonance. Then both the network's capacitance and the position of the tap were adjusted for

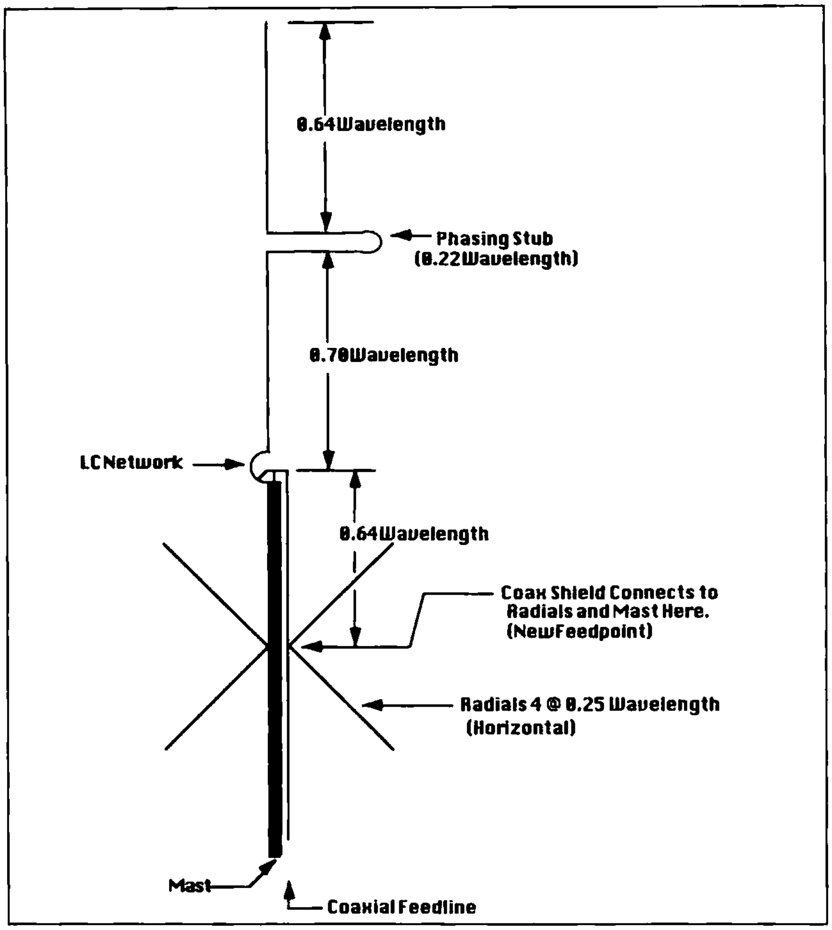


Figure 2. A look at the Stretched Vertical Gain Antenna's overall design.

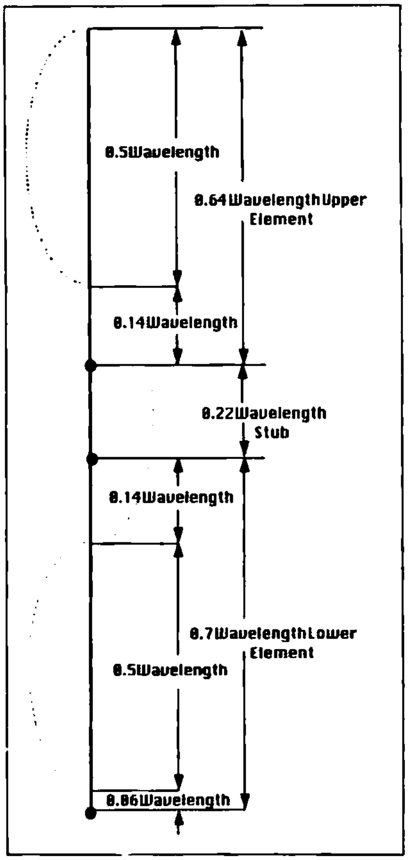


Figure 3. Electrical schematic and current distribution of the Stretched Vertical Gain Antenna.

the best match to the 52 ohm feedline. There is interaction among the antenna length and the network adjustments. I could achieve very nearly a 1:1 standing-wave ratio. A good match is important as feedline losses on 6m are more strongly affected by SWR than at lower frequencies. This is because feedline has more loss to begin with at higher frequencies.

The longer antenna produced definite increases in signal strength and quality as a 1/4-wavelength ground-plane antenna actually shows a slight loss relative to a dipole.

Longer Yet

I next lengthened the antenna to 0.64 wavelength, about 139 inches long. This length gives the maximum theoretical gain for a single clement working against its electrical image (the image needs to be provided by a ground-plane—the earth, a metallic surface, counterpoise, or radial system).

I used the same matching network, with adjustments. I saw slight further improvements in signal strength. Emboldened by success, I went for broke. What about using a pair of 0.64-wavelength sections in a two-element, vertical collinear array, like an extended double Zepp antenna?

Now, I don't claim originality for the design of the final version of this antenna. The inspiration came from the Cushcraft Ringo Ranger series of vertical VHF antennas.[4] My plan was simply to scale up the dimensions of this design from the 2m to the 6m band. The basic design consists of two roughly five-eighth wavelength sections in a vertical collinear array, separated by a phasing stub, and bottom-fed (see Figure 2) at the LC matching section.

When a stub of the correct length is placed between the upper and lower elements, it provides just the right amount of electrical delay (phase shift) to keep element currents in the correct relationships for maximum gain. Also, if the stub and element lengths are correct for each other, the current in the stub will be balanced and it will not radiate. See Figure 3 for the current distribution on the antenna.

Feedline Decoupling

Interaction between the antenna and the coaxial feedline is a frequent problem with end-fed vertical antennas. Unwanted current is caused to flow on the *outside* of the shield of the coaxial cable.

Coaxial cable is shielded and does not normally radiate. When it is correctly operated as a feedline, there is *no* current flow on the outside of the shield. That's why it

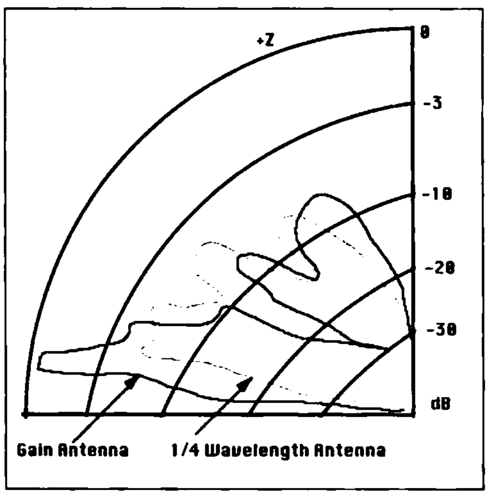


Figure 4. Elevation pattern comparison (see text).

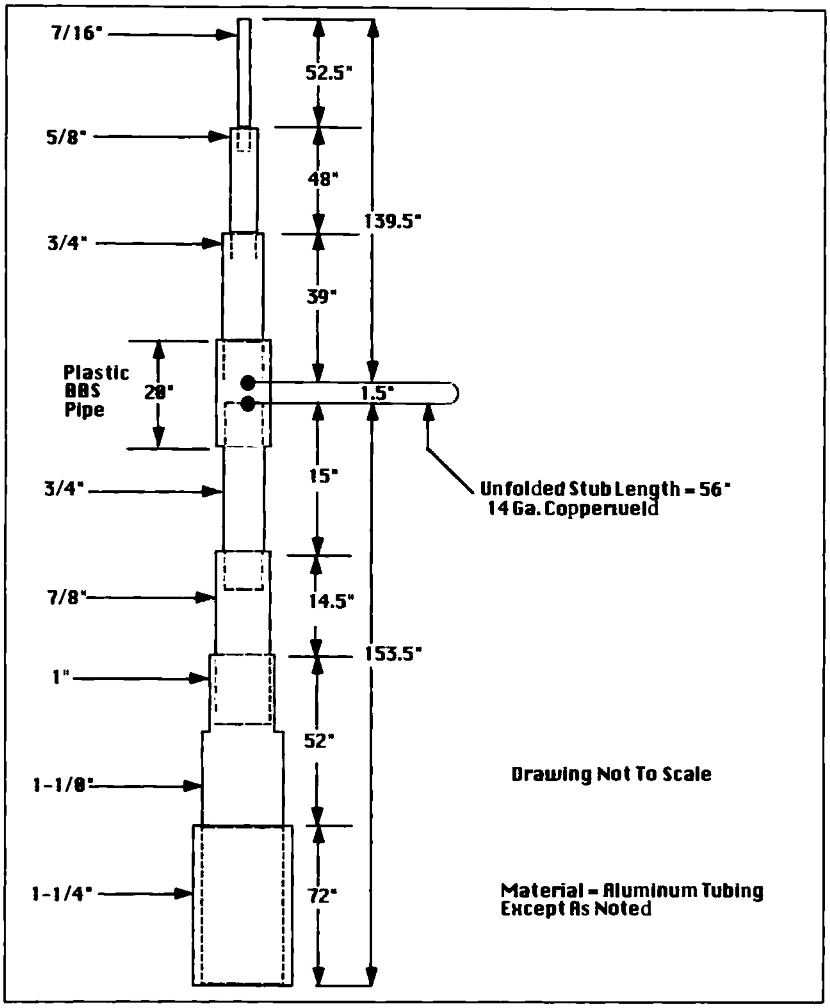


Figure 5. Sizes of aluminum tubing used in construction. Note that the stub connects through a section of white PVC pipe.

doesn't radiate! All of the current is then properly confined to the inside of the cable. It flows on the *inside* surface of the shield and in the center conductor, where it can't radiate. Currents on the inside and outside surfaces of the coaxial cable's shield can be different.

The extra current on the outside of the shield produces radiation from the feedline, which is unpredictable in effect due to differences in feedline installation (length and orientation). The strength and phase of this current flow is also unknown. Since current flow causes radiation, the outside of the coaxial cable will then radiate. This feedline radiation can interact with the wanted radiation of an antenna and spoil its pattern. A lot of work has been done on this effect.[5,6,7,8,9,10,11,12,13]

Some of the outside of shield current is induced by the antenna's own radiation field via mutual coupling between itself and the feedline. The amount of coupling in our case (vertical antenna and feedline oriented collinearly, end-to-end) is considerably less than it would be if, for example, the antenna and feedline were parallel and broadside to each other.[14,15]

Another, stronger, source of this induced current is the connection at the feed point. Sec the Appendix for details of how this happens.

This outside of shield current has nothing to do with the presence or type of matching network used. It is *not* due to current "leaking" through the coaxial shield.

So, to help isolate the feedline from the antenna and reduce outside shield current, I wrapped the coaxial cable into a six-turn air core RF choke about 6" in diameter, just below the coaxial connector at the base of the antenna. Additional decoupling can be had by slipping suitable (lossy at 50 MHz) ferrite beads onto the outside of the coaxial cable to form a choke.[16]

Improvements

Changes to the antenna's original design by the manufacturer have improved feedline decoupling in the Ringo Ranger II. This is accomplished by installing a decoupling section (an extra piece of coaxial cable) between the original feed point and four 1/4-wavelength radials which are now located 0.64 wavelength below the antenna's feed point. See Figure 2 for the overall design.

I connected the radials (which are connected to the mast) to the shield of the coaxial feedline at that point using a double female coaxial connector adapter (make sure to weatherproof these connections). A 144" (about 0.64-wavelength) piece of coaxial cable was then run up, using TV-type mast standoff insulators to dress it away from the mast, to the original feed point. Do not tape this new section of coaxial to the mast. The coaxial choke from before was placed just below the radials (the new feed point) for added isolation.

Refinements

Originally, I had simply scaled up all the dimensions of the Ringo Ranger from 2m to 6m. It worked well, but I wondered if it was truly optimum. After all, I had ignored the effects of length-to-thickness ratios of the elements—this can throw a design off, especially at VHF.

I used MININEC[17] to model and optimize the antenna for maximum gain while holding down the strength of the sidelobes. These sidelobes (normal for use of a 0.64-wavelength element—it's the price of more gain) point upward at the sky, a source of cosmic noise on 6m. In fact, cosmic noise is *the* limiting factor in reception (it sets the ultimate noise floor) on 6m.[18]

I altered the element lengths slightly to find the best design. While the final gain was just slightly less, the sidelobe levels were reduced even more. In other words, I optimized the antenna's gain-to-noise ratio. Surprisingly, the new dimensions were only a few percent different.

Figure 4 shows the elevation pattern of the final design along with a 1/4-wavelength groundplane antenna for comparison. Only the lowest elevation lobe is useful for communication purposes. The other lobes only point at the sky and raise the noise level. Note that the gain antenna has the strongest lobe near the horizon (most gain for signals) *and* the weakest lobes point at the sky giving least noise pickup.

As a reality check, in free space, a pair of 1/2-wavelength, end-to-end, collinear dipoles should give 1.9 dB more gain than a single dipole. Stretching them to 0.64 wavelength each should yield an additional 1.1 dB, for a total of about 3 dB (= 5.1 dBi) of theoretical gain over a dipole.[19]

Computed gain of the antenna over real ground is about 4 dB (7.5 dBi) more, and it hears about 2.3 dB less sky noise than a 1/4-wavelength ground-plane. This gives a 6.3 dB improvement in gain-to-noise ratio over a ground-plane.

The discrepancy in computed gain (7.5 vs. 5.1 dBi) is due to ground reinforcement effects and possible computer modeling errors. As always, we need to take both theoretical and computer model predictions with a grain of salt!

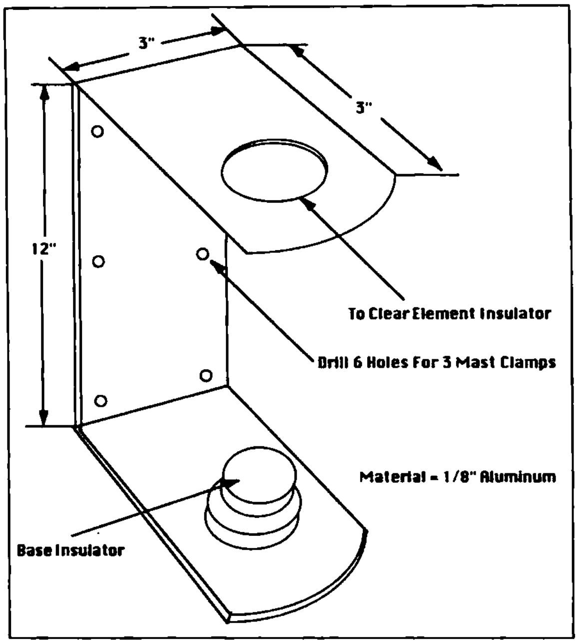


Figure 6. Base mounting bracket.

Mechanicals

The major consideration was now mechanical: How do you build a sufficiently strong, free-standing, 24-foot-tall vertical antenna? My first design was fine in calm weather, but it was too flexible and winds whipped it around greatly. The tip of the antenna was pulled over to almost 90 degrees by very strong winds, but it didn't break!

Even small amounts of antenna bending produced a lot of QSB on signals. This was because the main lobe, now quite narrow in elevation (like a pancake), was being pulled above and below the horizon as the antenna was bending.

The final sizing of aluminum tubing (mostly type 6061-T6) which cured the bending problem is shown in Figure 5. The two bottom pieces of tubing with the largest diameters make a double wall in the bottom section for added stiffness. The longer 1-1/8" diameter section of tubing runs all the way to the bottom of the antenna inside the shorter 1-1/4" section. The individual piece lengths of tubing are not too critical. In my case, they are the result of what was in the junk box. The *total* element lengths need to be correct, however.

Note the piece of white PVC plastic piping (3/4" inside diameter) used as an insulator for the phasing stub. The stub is made from 14-gauge Copperweld (copper-plated, steel core) antenna wire. The stub is then stiff, light, and self-supporting. It is mechanically and electrically attached to the metal tubing sections inside the PVC section, using small aluminum screws and nuts running through a hole the PVC and the tubing inside. Use the cold water type of PVC—it's thicker and stronger.

Connection between tubing sections is made in the following way: The ends of the outer tubes are slit with a hacksaw for about 2", and a stainless-steel worm drive hose clamp is tightened over it. A small aluminum screw and nut may also be run through each connection once the final lengths are set.

I used electricians' "compound for aluminum conduit joints" (for example Noalox) at all tubing connections to reduce corrosion and seizing, and enhance conductivity. The paste was still in place after 10 years of exposure. (I recommend this paste for use with all aluminum antennas.) All joints were weather-sealed with silicone-based bathtub caulk.

Figure 6 shows the insulated base mounting bracket rescued from a 1/2-wavelength 11m antenna. (The Cushcraft R4 vertical HF antenna uses the same kind of base bracket.) The large upper hole of the bracket contains a plastic insulating ring (not shown) in which the antenna is laterally supported but insulated from the bracket. This ring could be made from a short piece of PVC tubing slipped over the bottom end of the element.

The two-step plastic insulating base (which looks like a two-layer cake) shown at the bottom of the bracket supports the lower end of the antenna vertically and laterally. An aluminum bolt and nut is run through the bottom end of the antenna and the upper part of the insulating base. Three muffler or antenna clamps secure the bracket to the mast.

The antenna is strong and light, and has survived for 10 years with no noticeable mechanical or electrical degradation.

On The Air

Results using the final design were gratifying. Ground-wave range increased markedly over the ground-plane antenna, which I kept up for comparison purposes. Signals not copyable on the ground-plane antenna are Q5 on the gain antenna.

On-the-air improvements were considerably greater than would be suggested by gain increase alone. Our antenna "hears" well not only because it has gain but because it ignores sky noise, thus improving the gain-to-noise ratio. The FM threshold effect (the non-linear relationship between the FM signal-to-noise ratio and carrier-to-noise ratio) magnifies the effect of this.[20]

Current Flow on the Outside of Coaxial Feedline

To see why this happens, let's look at the currents at the bottom end of a vertical antenna, using the matching network described in Figure 1. See Figure 7 for the various current flows.

I_A is the antenna current at the bottom end of the antenna. It flows into the top of the coil. Current I_L flows from the coil tap into the center conductor of the coaxial line. A current of equal strength to I_L but opposite in direction, $-I_L$, flows on the *inside* surface of coaxial shield. Current I_B flows out the bottom end of the coil. I_S flows on the *outside* of the coaxial shield.

Using Kirchoff's current law (the algebraic sum of currents flowing into and out of a junction must equal zero), we get two equations:

$I_A = I_L + I_B$

and

$I_S = I_L + I_B$

We can solve the first equation for I_B and substitute it into the second.

The result is that I_S is equal to I_A. In other words, the amount of current that flows on the outside of the coaxial shield is the same as the amount of current which flows at the bottom end of the antenna. (This analysis is from Endnote 11.)

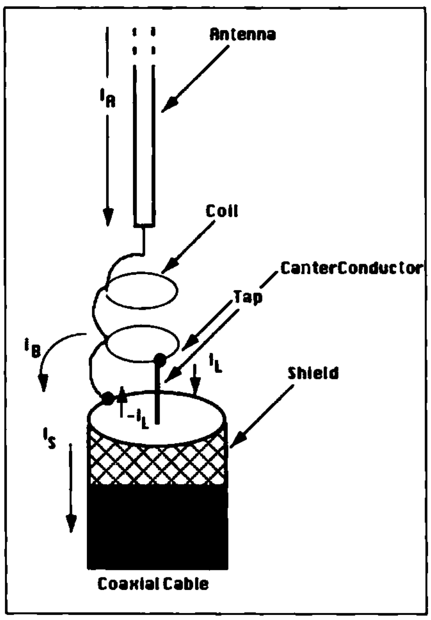


Figure 7. Current flows at the bottom end of a vertical antenna (see text).

Footnotes:

[1] I have seen this effect on reception of VHF TV signals in remote mountainous regions. A

highly directional antenna's beamwidth in azimuth *appears* to become very broad because the diffracted and scattered signal no longer arrives from only one direction.

[2] Orr, W., "Gamma-Loop-Fed Vertical Dipole," *Ham Radio*, May 1972. References 2, 3, and the reference of this footnote contain an inductance nomograph.

The inductance of a single turn coil is approximately:

$L = 0.016D(2.3\mathrm{Log}_{10}(8D/d) - 2)$

where L is the inductance (µH) of the coil, D is the coil diameter (inches) and d is the wire diameter (inches). (Formula from Terman, *Radio Engineer's Handbook*, 1st Edition, McGraw-Hill, New York, 1943, p. 52).

[3] Orr, W. and S. Cowan, *The Radio Amateur Antenna Handbook*, Radio Publications, Inc., 1978, p. 101.

[4] Manufactured by Cushcraft Corporation, Manchester, NH 03108.

[5] Knaack, R., "Detuning Sleeve for the Ringo Ranger," *QST*, May 1983.

[6] Orr, W., "More About Radials," *Ham Radio*, November 1984. Discusses the use of radials longer than 1/4 wavelength.

[7] Meyer, P., "The Truth About 5/8-Wavelength Vertical Antennas," *Ham Radio*, May 1974.

[8] Aurik, L., "Equipment Review: The ASEA Isopole 2-Meter Antenna," *QST*, April 1980.

[9] Belrose, J., "Notes on Coaxial Baluns," *QST*, June 1983.

[10] Jasik, H. (Editor), *Antenna Engineering Handbook*, McGraw-Hill, 1961, pp. 22-4 to 22-14.

[11] Reynolds, D.K., *Facts About Proper VHF Vertical Antenna Design*, (pamphlet), Advanced Electronic Applications, Seattle, WA, 1979.

[12] O'Dell, P., "Decouple VHF Verticals," *QST*, April 1982.

[13] A coaxial (unbalanced) feedline connected directly to a center-fed dipole (a point of voltage balance) also suffers from feedline radiation due to outside-of-shield current flow. This may or may not be desirable. Use of a voltage-type balun at the feed point eliminates this cause of it.

[14] *The ARRL Antenna Book*, 13th Edition, ARRL, 1978, Figures 4-7 and 4-8.

[15] Moxon, L.A., *HF Antennas for All Locations*, Radio Society of Great Britain, 1982, Figure 5.2.

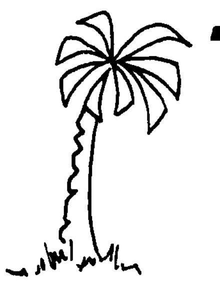
[16] Palmer, B.R., "Ferrite Shield-Current Chokes Cure Stray RF on Vertical-Antenna Transmission Lines," "Hints and Kinks," *QST*, January 1994, p. 78.

[17] Lewallen, R., "MININEC: The Other Edge of the Sword," *QST*, February 1991.

[18] Fisk, J., "Receiver Sensitivity, Noise Figure and Dynamic Range," *Ham Radio*, October 1975.

[19] *The ARRL Antenna Book*, op. cit., pp. 135, 137.

[20] Decasari, R.J., "The FM Advantage," *Ham Radio*, September 1984. At low signal strengths (low carrier-to-noise ratio), FM's signal-to-noise ratio is markedly inferior (it takes about 9 dB more carrier strength for an equal signal-to-noise ratio) to SSB. At higher signal strengths, its signal-to-noise ratio is superior. The crossover region is called the FM threshold. At low signal strengths, small improvements in carrier-to-noise ratio give big increases in FM signal-to-noise ratio. This can exaggerate antenna gain and/or gain-to-noise ratio improvements.



The CW Operator's Friend

Simply push a button and send those frequently-repeated CQs, IDs and QTHs.

by Herbert M. Rosenthal WV5Q

I read "The Morse Messenger" by Scott Edwards KF7VS (*73 Amateur Radio Today*, June 1994, page 46) with keen interest. His device uses a PIC chip in a CW message generator for foxhunts, repeaters, etc. I thought I could use the chip in an add-on to my squeeze key and MFJ keyer. The idea was to place several "buttons" in close proximity to the paddles, and to put the electronics inside the keyer. Then, with just an inch or so movement from the paddles to the buttons, I could summon up a CQ or "OP HR IS HERB HERB" sequence with the touch of a button. This adjunct would certainly eliminate manual sending of many repeat messages.

Well, I put it all together, and it works just great! I'd like to share this with all the CW ops. Refer to the original article as you read this. Here goes:

It's Simple!

I ordered a chip from Scott, programmed with my call and sequences for DE, CQ, CQ DX, QTH, and OP, following his instructions to count spaces and to limit the total count to 92 for all six messages. Figure 1 shows my messages; the combination of highs/lows necessary on the M0, M1, and M2 memory select lines remains the same for any message. An array of 1N914 diodes and pull-up resistors is used to make each of the six buttons select the proper message; this takes 17 diodes and three resistors. They are mounted on the same perfboard that holds the message buttons. This board fits mostly under the key, and the buttons stick out in front, very close to the paddles, three on each side of the paddles. Mount the board to the key as you wish; I used duct tape. The speaker (audio) output and tone-select functions are not used.

The rest of the electronics is mounted on a small piece of perfboard, with a socket for the PIC chip. Then the assembly is direct-wired to the keyer, wrapped with a turn or two of paper to prevent shorts, and stuffed inside the keyer cabinet. A thin, six-conductor shielded cable connects to the perfboard under the keyer, and you're up and running. Use tiny switches that take just the barest touch to operate—Digi-Key has such switches; Radio Shack 275-016 switches will work, but they are not really small. Look for small, sensitive switches. Defunct computer mice are a good source for switches and cable.

A diode connected to each switch grounds a common R-C-R circuit to give a negative-going pulse for the trigger line. Thus, *any* key depressed selects its message *and* also triggers the start of the message.

The XMTR LED is mounted on the keyer panel as a "RUN" indicator, and serves to advise you when a message sequence is complete.

Modification

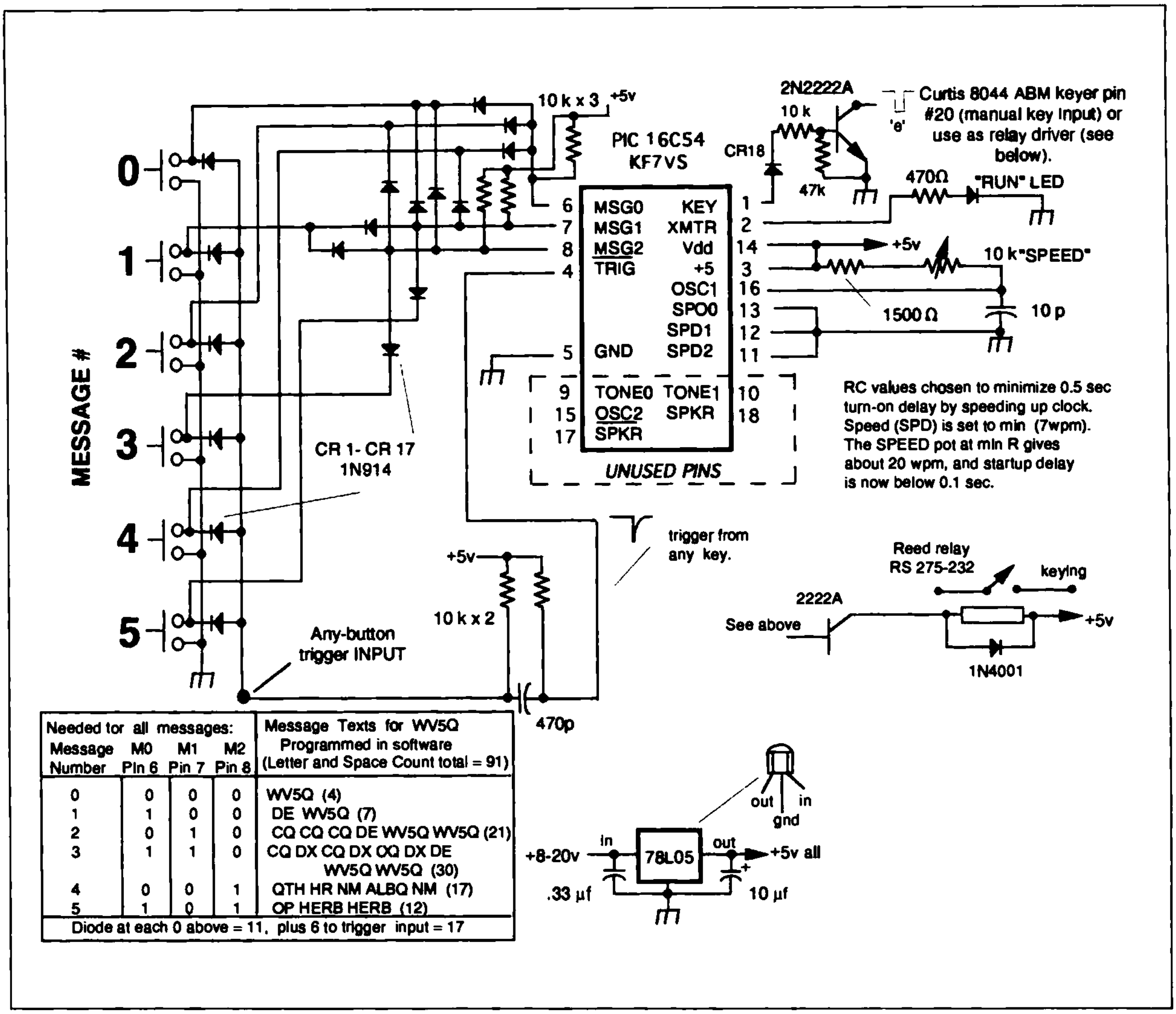
There is a 0.5-second delay programmed in the software that is *undesirable* for this application; it takes too long at moderate CW speed for the message to begin. I reduced this wait time by speeding up the operating frequency of the chip, replacing the original RC components with a 10 pF capacitor and a 1,500 ohm fixed resistor in series with a 10k ohm pot. Of course, this throws the original speeds way off, but with the new pot set at zero ohms, and the three speed lines pulled to zero, the original 7 wpm is now about 18 wpm, and the start delay is about 0.1 second—acceptable. To QRS, increase the setting of the pot; this *does* increase the start delay, but it's manageable.

They KEY output drives an inverting NPN transistor to give a low-going CW sequence. I wired this to the manual key input of the MFJ keyer (pin 20 on the Curtis 8044ABM chip). Others may use this transistor to operate a reed relay as shown; the contacts are then "clean" and may be used for positive or negative keying, or connected across your keyer's output.

That's it. The temptation to do a repeat circuit for the CQ messages was strong, but I decided against this; a single 3x2 suffices.

I have written Scott, suggesting that he consider re-doing the PIC program for the button function. This would eliminate the memory diodes, the turn-on delay, the start trigger, the tone and speaker leads, providing a simple one-chip, six-button keyer. Until such a chip is available, you can do it "my way."

See Figure 1 on page 38



Needed for all messages: Message Number	M0 Pin 6	M1 Pin 7	M2 Pin 8	Message Texts for WV5Q Programmed in software (Letter and Space Count total = 91)
0	0	0	0	WV5Q (4)
1	1	0	0	DE WV5Q (7)
2	0	1	0	CQ CQ CQ DE WV5Q WV5Q (21)
3	1	1	0	CQ DX CQ DX CQ DX DE WV5Q WV5Q (30)
4	0	0	1	QTH HR NM ALBQ NM (17)
5	1	0	1	OP HERB HERB (12)
Diode at each 0 above = 11, plus 6 to trigger input = 17				

Figure 1. KF7VS Morse Messenger as PIC Button Keyer. Adapted by Herbert M. Rosenthal WV5Q, 1994.

Polarity Protection Plus

Don't take a chance of smoking your next project!

by Frank Kamp K5DKZ

Any project that is designed to run off batteries or an external supply needs reverse polarity protection. For applications requiring current levels under one amp, a simple silicon diode in series with the positive power supply lead prevents damage should the supply leads be reversed. At higher current levels, a diode across the supply terminals can cause an in-line fuse to open under reverse polarity conditions. Both methods protect the load from damage but do little to prevent frustration for the careless user.

In the case of the series-connected diode, reversing the power leads will prevent the circuit from drawing current. The resulting operational failure can be easily corrected by reversing the power supply leads. Unfortunately, there are a multitude of other factors that can lead to operational failure. Most probably, the user did not reverse-connect the power leads intentionally. That lack of intent could have a person needlessly searching for other causes of failure before discovering the reverse connection. Intentionally reverse-connecting the power input to non-functioning electronics devices is not a well-accepted troubleshooting procedure. What we really need here is a polarity *correction* circuit. By adding three additional diodes we can provide a polarity correction feature that has inherent polarity protection and does not result in undue frustration.

Four diodes connected in a simple single-phase bridge circuit will steer the supply current to the correct polarity regardless of the input polarity to the bridge. The positive output of the bridge is connected to the

positive input of the circuit. The negative output of the bridge is connected to the negative input of the circuit. Now, power of either polarity can be applied to the AC terminals of the bridge and the load will still receive properly polarized supply current.

This trick is not without some minor drawbacks. The most significant drawback is the additional voltage drop across the extra diodes. In the case of silicon diodes, you will experience a 1.4 volt drop between the input and output of the bridge. A power dissipation concern becomes a problem when load currents in excess of a few amps are required. A 2 amp load will dissipate almost 3 watts in the diodes.

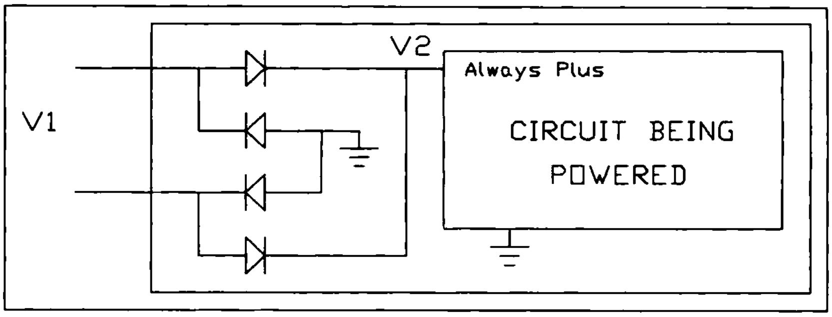


Figure 1. V1: Any polarity DC voltage 1 or 2 volts greater than that required at V2. The current rating must be sufficient for the circuit being powered.

The usefulness of this method far outweighs its drawbacks when we apply it to low-current devices that have their own voltage regulation. If we add a large-value filter capacitor across the output of the bridge, we end up with a device that can have a large range of power sources. Either AC or DC wall bug-style supplies could be employed and we would no longer have to worry about the polarity of the DC supplies. We can now use any source of AC or DC for input to the bridge, assuming its supply voltage is large enough to overcome the 1.4-volt drop through the bridge and the possible 3-volt drop through any regulators in the load. This generally means that a wall bug-style supply with a minimum of 9 volts will be required for a 5-volt circuit. A 12-volt circuit will need a 16-volt supply. If the circuit uses devices that operate over a large voltage range, like CMOS devices, regulation might not be required at all. In such an application, power sources with voltages ranging from 5 to 16 volts AC or DC could be employed.

"The usefulness of this method far outweighs its drawbacks when we apply it to low-current devices that have their own voltage regulation."

So now we have polarity protection, polarity correction, and the versatility of using a large range of assorted AC or DC power supplies. I figure that is a lot of performance for the cost of three additional diodes.

DTMF Computer Interface

Harness the power of your PC to operate DTMF tone controls.

by Richard Taylor K7CAH

The Capitol Peak Repeater Group operates five repeaters on Capitol Peak, near Olympia, Washington. Three of the repeaters are linking repeaters for the Evergreen Intertie system. One repeater is on 145.47 and one is a redundant repeater that can be switched in or out of the system. The entire configuration is controlled by two microprocessor-based controllers with programmable speech, voltage and temperature sensors, an autopatch, and weather receivers.

There are over 600 user and control codes involved in the setup and operation of the two controllers. This does not include the speech or macro programming. A hard reset of the system involves the long and tedious job of reprogramming. Also, changing system configurations requires inputting several long strings of digits, one at a time. A faster means of programming the repeaters was clearly needed.

The following computer interface evolved out of this need. It is a small, easily-built unit that interfaces an IBM-compatible computer with the mike input of the transceiver. It generates all 16 DTMF tones that are inputted from the computer keyboard. With a little modification it can also be used through telephone lines.

The interface was designed around the SK22859 tone-generator chip. This chip is used primarily as a replacement for the tone generators in telephone Touch-Tone pads and is readily available. It is also capable of generating all 16 DTMF tones and uses an easily-available 3.58 MHz TV type crystal in its oscillator circuit. The chip is a low-voltage (3 volts) low-current device, which makes it ideal to use with a laptop computer both in the field and at home. The interface connects to the computer via

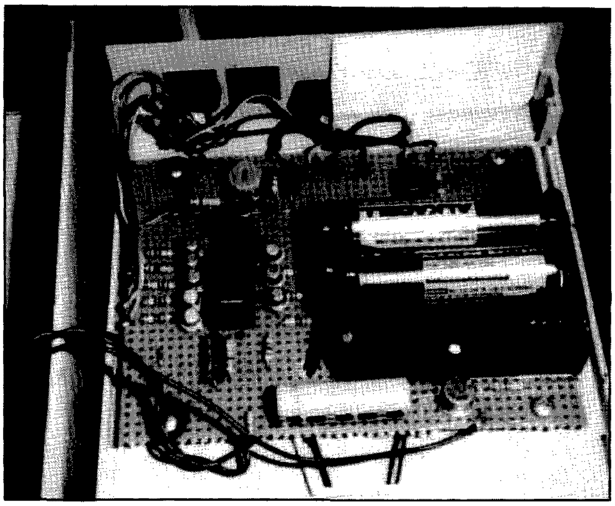


Photo A. An early prototype of the DTMF Computer Interface built on perfboard.

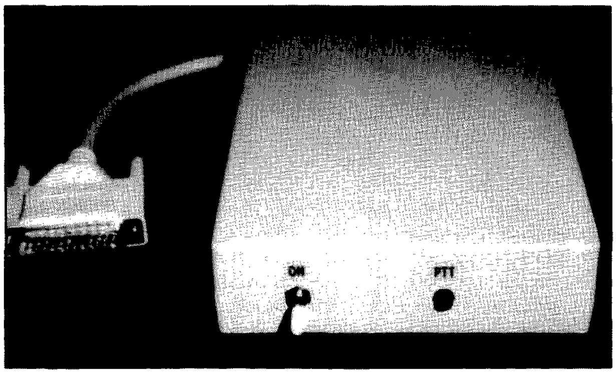


Photo B. The DTMF Computer Interface looks inconspicuous in its own little box.

computer printer port is used. This port is easily programmable in BASIC and is readily accessible without any modification to the computer. The portion of this port that we are mainly interested in is the eight "Data" lines and the "Strobe" line. The Strobe line is used to key the mike PTT. Each of the

the parallel printer port. This port can be programmed for both input or output, and is probably one of the easiest ports to use to connect outside devices to the computer.

Operation

The standard DTMF (Dual-Tone Multiple-Frequency) keypad is arranged in rows and columns (see Figure 1). Each row and each column has a single frequency tone associated with it. By connecting a row and a column together, two tones are generated and combined to produce a standard dual tone associated with a particular digit or letter (A, B, C, D). To produce the dual tone for the digit 3, row 1 is connected to column 3. This produces and combines the tones of 697 Hz and 1477 Hz, representing the digit 3. Tone generating and combining is done within the SK22859 IC. By grounding both a row and a column on the IC, the proper tone is produced. Output is audio, sufficient to drive a small speaker.

Instead of the DTMF keypad, the

```
                              COLUMN
                     C1    C2    C3    C4
697 Hz ____ 1|____  2|____  3|____  A|________ R1
770 Hz ____ 4|____  5|____  6|____  B|________ R2  R
852 Hz ____ 7|____  8|____  9|____  C|________ R3  O
941 Hz ____ *|____  0|____  #|____  D|________ R4  W
             |       |       |       |
             1       1       1       1
             2       3       4       6
             0       3       7       3
             4       6       7       3
             Hz      Hz      Hz      Hz
```

Figure 1. DTMF keypad.

Row/Column		R4	R3	R2	R1	C4	C3	C2	C1	
Data line #		8	7	6	5	4	3	2	1	Decimal value for BASIC "OUT" command
Decimal		128	64	32	16	8	4	2	1	
	1	0	0	0	1	0	0	0	1	17
	2	0	0	0	1	0	0	1	0	18
	3	0	0	0	1	0	1	0	0	20
	4	0	0	1	0	0	0	0	1	33
	5	0	0	1	0	0	0	1	0	34
D	6	0	0	1	0	0	1	0	0	36
T	7	0	1	0	0	0	0	0	1	65
M	8	0	1	0	0	0	0	1	0	66
F	9	0	1	0	0	0	1	0	0	68
	*	1	0	0	0	0	0	0	1	129
	0	1	0	0	0	0	0	1	0	130
	#	1	0	0	0	0	1	0	0	132
	A	0	0	0	1	1	0	0	0	24
	B	0	0	1	0	1	0	0	0	40
	C	0	1	0	0	1	0	0	0	72

Figure 2. Printer port data output lines.

data lines is either on or off (+5 volts or 0), depending on the binary number associated with all eight data lines (see Figure 2). Possible combinations of 255 numbers are available; however, only 16 numbers are used for our interface. The combination of four rows and four columns on a DTMF pad and eight data lines works out well. All we need to do is assign each data line to act like a row or column on a DTMF keypad. We then program the computer to output the correct binary number to the printer data lines that represent the decimal digit entered at the keyboard. The binary output from the printer port (+5 volts or 0) is sent to the IC keying transistors. The keying transistors ground either a row or column line on the IC. At the same time, the Strobe line is keyed on. This in turn keys (grounds) the transceiver PTT line and sends the appropriate tone out over the air.

As is usually the case, there is always something that makes a simple project just a little more difficult. However, in this case it is just a minor irritation. Not all computers use the same port assignment to access the printer port. LPT1 and LPT2 are used to designate the printer ports. LPT1 should have an address assignment of decimal 956 or 888 and LPT2 of 632. The strobe line address will be either 890, 958, or 634. So far, I haven't found any computers that do not use at least one of the above port address assignments. However, if you have trouble running the program, consult your computer manual and make sure at least one of the printer port assignments matches one of the above. In the program listing, the printer port used is LPT1, with a port assignment of 888 and strobe assignment of 890 (C=888:W=890). If the program will not operate, change C and W.

Construction

Parts placement is not critical. I used Radio Shack perfboard for component mounting on the prototype shown in Photo A. You can also use a drilled and etched PC board, like the one pictured in Figure 5. All the switching transistors are 2N2222, although any general-purpose NPN transistor should work. Parts values also are not too critical. However, the 680 ohm load resistor (R5) on pin 16 of the IC should be as close as possible. The SK22859 IC is static sensitive, so it is best to use an IC socket and install the IC after all the wiring has been completed.

I cut a six-foot DB25 double-male computer cable in half to obtain the plug and cable to plug into the printer port. Use an ohmmeter to trace out the pins and wire colors for the data and strobe lines. A much neater installation would be to use a DB25 jack mounted to the project box, and use a separate cable to connect it to the computer.

Most transceivers today use a 600 ohm microphone impedance. The interface audio can be wired into the microphone input along with the station mike without causing any loading. If you have a high impedance mike input on your radio, you may have to disconnect the station mike while using the interface.

I used a 3 volt wall-type transformer power supply to power the unit. This is the type used to power small battery-operated cassette recorders and is available at Radio Shack. For portable operation, two AA batteries in series work just fine. However, do not put more than 5 volts across the IC. S1 is a double-pole single-throw switch. S1A applies power to the circuit, while S1B connects the strobe line. The interface should be turned off when not in use to prevent inadvertent transmitter key-up when the computer is used for other programs.

Operation

The program listed was written in GW-

Program

```
100 CLS
110 C=888:REM DATA LINE ASSIGNMENT. LPT1 888 OR 956 LPT2 632
120 W=890:REM STROBE LINE ASSIGNMENT. LPT1 890 OR 958 LPT2 634
130 PRINT:PRINT:PRINT
140 PRINT "INPUT ONE LINE AT A TIME. PRESS ENTER TO SEND"
150 PRINT "PRESS ENTER ON A EMPTY LINE TO QUIT"
160 PRINT:PRINT:
170 LINE INPUT I$
190 IF I$="" THEN END
200 OUT C,0: REM SET ALL DATA LINES TO 0
210 OUT W,12: REM KEY TRANSMITTER
220 FOR N=1 TO 100:NEXT N
230 FOR M=1 TO LEN(I$)
240 A$=MID$(I$,M,1):GOSUB 1020
250 A$=" "
260 NEXT M
270 OUT W,13: REM TURN OFF TRANSMITTER
280 GOTO 170
1020 REM OUTPUT ROUTINE
1030 IF A$="1" THEN OUT C,17:GOSUB 1190
1040 IF A$="2" THEN OUT C,18:GOSUB 1190
1050 IF A$="3" THEN OUT C,20:GOSUB 1190
1060 IF A$="4" THEN OUT C,33:GOSUB 1190
1070 IF A$="5" THEN OUT C,34:GOSUB 1190
1080 IF A$="6" THEN OUT C,36:GOSUB 1190
1090 IF A$="7" THEN OUT C,65:GOSUB 1190
1100 IF A$="8" THEN OUT C,66:GOSUB 1190
1110 IF A$="9" THEN OUT C,68:GOSUB 1190
1120 IF A$="0" THEN OUT C,130:GOSUB 1190
1130 IF A$="*" THEN OUT C,129:GOSUB 1190
1140 IF A$="#" THEN OUT C,132:GOSUB 1190
1150 IF A$="A" OR A$="a" THEN OUT C,24:GOSUB 1190
1160 IF A$="B" OR A$="b" THEN OUT C,40:GOSUB 1190
1170 IF A$="C" OR A$="c" THEN OUT C,72:GOSUB 1190
1180 IF A$="D" OR A$="d" THEN OUT C,136:GOSUB 1190
1190 FOR T=1 TO 900:NEXT T:REM  HOW FAST TONES ARE SENT
1200 OUT C,0:REM SET ALL DATA LINES TO 0
1210 RETURN
```

Figure 3.

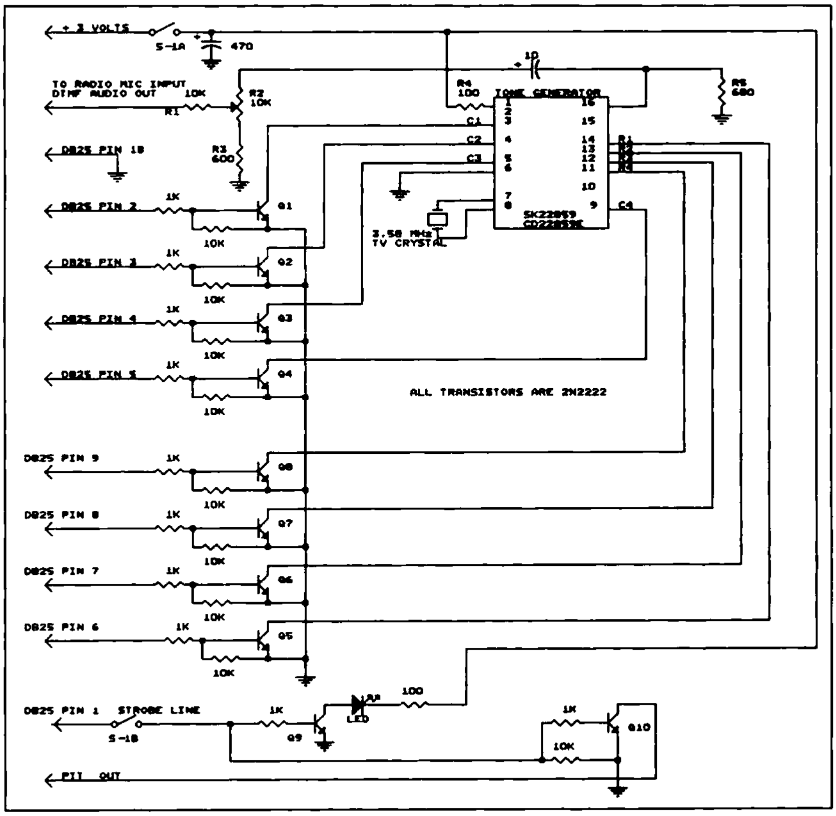


Figure 4. Schmetic diagram for the DTMF Computer Interface.

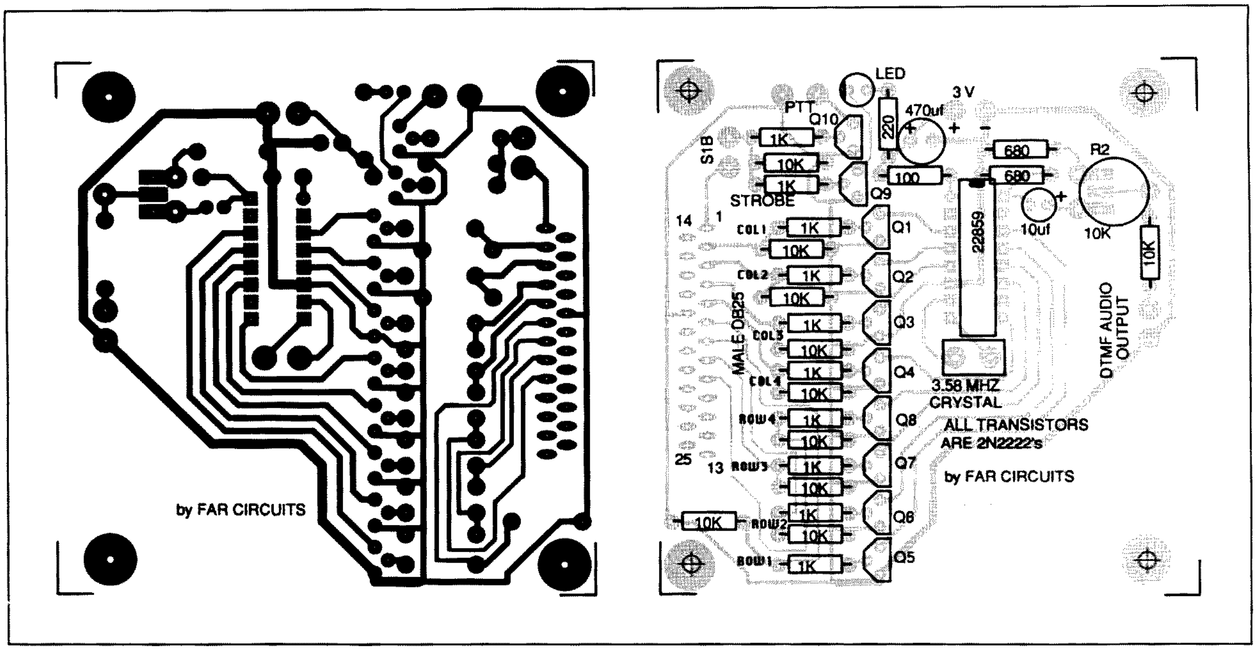


Figure 5. Drilled and etched PC boards are available for $4.50 plus $1.50 S & H per order from FAR Circuits, 18N640 Field Ct., Dundee, IL 60118.

BASIC and should run on any computer using DOS 2.0 or greater. Bring up BASIC on your computer, then type in and save the program. Connect the interface to your computer printer port and the radio to the interface. Run the program and input several numbers. When the ENTER key is pressed on the computer, the radio PTT should light and DTMF tones should be sent out over the air. If the PTT light does not light, change W in line 120 of the program. If no tones are outputted, change C in line 110. Once the program and interface are up and running, adjust R2 to obtain 3 to 3.5 kHz deviation. This will be the point just above the threshold where the tones will access your repeater. Too much audio will cause distortion in your radio and will not be decoded at the repeater.

Connecting two rows to ground produces a single frequency tone. The BASIC command "Out C,48" (see text for the value of C) connects Row 1 and Row 2 to ground, producing a single tone. This can be useful for producing a test tone or, with a little programming, to send your call in CW.

A complete program with data storage and documentation is available on 5-1/4 disk for $15 U.S. from the author. Write to me at 613 N. 5th, Tumwater, WA 98512. ■

Parts List

1	Tone generator, RCA SK22859 or CD22859E
10	2N2222 transistors or equivalent
1	10k ohm variable resistor
1	100 ohm resistor
1	680 ohm resistor
10	1k ohm resistor
9	10k ohm resistor
1	470 µF capacitor
1	10 µF capacitor
1	3.5795 MHz TV color burst crystal, ECG 358 or equivalent
1	16-pin IC socket
1	Red LED
1	DB25 male computer cable

HAM HELP

Number 13 on your Feedback card

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

I need the manuals for: (A) JOHNSON VIKING Ranger Type #249-161 SN #62917; (B) EICO RC Bridge Model 950B SN #71492; (C) Minneapolis Honeywell Reg. Co., Rubicon Instruments WHEATSON Bridge Model #1071. I will pay for originals or copies. *Zachary Stakis, c/o Aeromotive Eng. Inc., 58 Seabring St, Brooklyn NY 11231.*

WANTED: A copy of the Manual for PRIDE 100A Amateur Radio Bi Linear, 80—10 mtr. Model MB0100-02. I will pay expenses! I also need a copy of the Manual for SIGMA AF-250L AM/FM Analyzer. *Kenny Hudson K5QLP, 1021 8th St., Bay City TX 77414.*

WANTED: Manual/schematic for B1 Linear Amplifier Model 150 made by PALOMAR INSTRUMENTS, *not* Palomar Engineers Inc. *Thomas Wright N4GPV, 3758 Matheson Ave., Miami FL 33133.*

Does anyone have the schematic for a Heath DX-100? If so, please contact *Lowell Blevins, 4509 Westchase Circle, Grapevine TX 76051.*

NEEDED: Schematic or 10 meter conversion info for J.C. PENNY 40 channel SSB CB (Cat. #9818360). Also, I need the schematic for UNIDEN Bear Cat 100 Pocket Scanner. I will pay copy costs. *Dave Kovatch, 7346 Brushcreek Rd., Fairview TN 37062. Tel. (615) 799-8147.*

I need a copy of the Service Manual for a MARANTZ Ampli/Tuner, Model SC1000, so that I can make repairs. Also, I need the Owner's Manual. Thank you. *Xavier Duclos VE2XTT, 7194 Casgrain, Montreal Quebec, Canada H2R 1Y1.*

WANTED: A copy of the Manual for HEATHKIT Frequency Counter Model IB-101. Write to *Robert Schlegel N7BH, 2302 286 St East, Roy WA 98580.*

73 Review

Number 15 on your Feedback card

by Gordon West WB6NOA

Bencher, Inc.
831 N. Central Avenue
Wood Dale IL 60191
Telephone: (708) 238-1183;
Fax (708) 238-1186
Price Class: RJ-1 (black-painted steel base)—$69.95;
RJ-2 (chrome-plated base)—$79.95

The Bencher Chrome Straight Key

Experience the feel of a well-built code key.

Remember the days of the J-38 key and its unique feel? If you enjoy the touch and mechanics of a straight key, plus the familiar click-action of sending without paddles, you will enjoy using the new Bencher RJ-1 that will bring back some wonderful straight key memories.

"Give me a good straight key, and I'll have a race with you on any electronic keyer," quipped the late Jim Rafferty N6RJ. The "RJ" designation on the Bencher straight key is a memorial to one of the finest CW operators in the country. "The action of a good straight key has got to be felt to be appreciated," said Rafferty.

The Bencher straight key was developed in response to requests from a number of customers and dealers wanting something new from CW key guru Bob Locher W9KNI. You can tune in Bob most evenings at the very bottom of the 20 meter band. Need I say more? I have witnessed him drinking a cup of coffee, munching a sandwich, and carrying on a conversation, all the time sending CW to a rare DX station somewhere else in the world!

"Although there are conventional straight key designs that we studied, no effort was made to copy them," comments Locher. "We wanted our engineering team to create a product that would utilize modern materials and manufacturing techniques to meet the traditional straight key requirements," adds Locher. The RJ-1 chrome-plated key on a black-painted steel base uses oil-impregnated sintered bearings at all pivot points, and stainless steel adjustment screws. Of course, a complete range of locking adjustments of all movement and tensioning is provided along with an Allen wrench for the adjustment that feels right to you.

"We assemble everything at the same place where we turn out our popular Bencher paddles," adds Locher. "And we are talking about assembly personnel at our facilities who have the skills of a Swiss watchmaker—white gloves and the works," smiles Locher.

The Expert Users Approve!

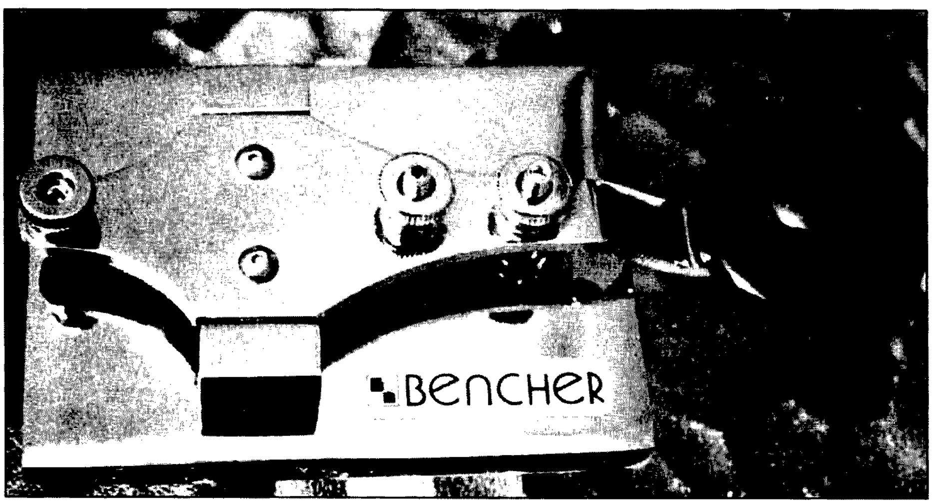
We ran our tests on the Model RJ-2. And, while you might not think that there is any good way to test a straight key, we found the best way was to invite accomplished CW enthusiasts to come over and rate its feel. "I'm going to retire my J-38," comments Bob Gregg AB6CH. "I liked the oversized black plastic knob with a second plastic ring to rest my fingers on," comments Roy Stephens AC6CQ. "The soldered tabs on the bottom also make for a quick hook-up," adds Stephens. On the bottom of the key there is also a holder for the Allen wrench adjustment tool, plus a plastic strain relief to keep your two-conductor keyline from tugging at the soldered connections.

The base of the key is common with one side of the key line solder lug. The other side is insulated off of the base, and connects to the gold-plated contacts that gave us a crisp open-and-close connection. Locher indicates that these are the same contact points that are found in all of his proven Bencher paddles.

For adjustments, you've got them! We found that you could adjust the knob height, adjust the contact spacing, and adjust the spring tension all with knurled knobs. The Allen wrench is there only if you need to completely strip down the key for an annual cleaning.

A set of instructions cautions never to spray any contact cleaner into the ball bearings. It also cautions against using steel wool or abrasive cleaners on any Bencher key or paddle. The bearings are Oilite, and no lubrication should ever be needed.

Best of all, the key is massively heavy, so it won't be hopping around your operating desk as you are pounding out those dits and dahs. And, just like all Bencher paddles, the key should last for a lifetime of amateur radio operation.



Departing from its traditional practice of using the prefixes of rare countries as the product identifier in the paddles, the "RJ" designation is to honor the memory of Jim Rafferty N6RJ, who was a close friend and once fellow co-worker of Bencher Management.

The keys are available in two versions—RJ-1 for $69.95 with chrome-plated parts on a black-painted steel base, and RJ-2 for about $79.95 with chrome-plated parts on a chrome-plated base.

For more information on the complete line of Bencher paddles, keys, baluns, and filters, write Bencher, Inc., 831 N. Central Avenue, Wood Dale, Illinois 60191; (708) 238-1183.

RTTY LOOP

Number 16 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

Over the past 18 years, the December "RTTY Loop" has often served as a Guide to the Perplexed, answering that eternal question, "What gift to get for your favorite ham radio operator?" With Channukah coming relatively early this year, beginning during Thanksgiving weekend, followed by Christmas and Kwanza at the traditional late December times, I thought It might be nice to return to those thrilling column ideas of yesteryear. So, with a hearty Hi Ho Silver, here we go!

As always, we will first take a look around 73rd Street (you're holding the directory in your hand). How about a good book? The National Amateur Radio Association offers a copy of Dave Ingram's *How To Get Started In Packet Radio*, reviewed in this column many months ago, for $9.95 plus shipping. Call them at (206) 869-8052 for more information.

Chuck Harrington Software offers PacketPet for Windows, an excellent packet terminal program described here a few months back. For $49.95 plus shipping, this Is a nice package. Call them at (407) 679-9017 for Information, or take advantage of the shareware version, recently updated, on Disk #5 of the "RTTY Loop" disk collection.

Packet Power is a new periodical which looks interesting. I have not seen an issue, but their ad in *73* gives an address of Box 189, Burleson TX 76097. Might be worth a peek.

A little packet modem in a connector, suitable for use with the BayCom program on Disk #2 of the "RTTY Loop" disk collection, is available from Tigertronics tor $49.95 plus shipping. Call (800) 8BAYPAC for information.

"Thank goodness for packet radio! If you are running Windows, OS/2, DESQview, etc., you will find paKet runs quite happily in the background as a simple DOS task."

Now, if all of these are just too rich for your blood, I have one more item up my sleeve that has just got to be affordable: Disk #7 of the "RTTY Loop" disk collection! This new disk comes complete with the following programs:

paKet version 6
PAKET6.ZIP

Tony Lonsdale VK2DHU, the author of paKet, describes it as a communications program developed especially for use with packet radio, although it can be used for other modes with the appropriate equipment. It is designed to run on any IBM-compatible computer system and to communicate through a standard TAPR-compatible Terminal Node Controller (TNC).

The program is very easy to use, even for newcomers to this field. As you gain experience with the system, you can explore some of the more sophisticated features which are provided to meet the needs of even the most demanding packet operators. It is simple if that is what you want; and it is sophisticated if that is what you want.

The modern trend Is towards Graphical Environments with the likes of Windows, or OS/2. paKet is written to run as a plain DOS program, so if you have an old XT with a CGA or even a Mono display system gathering dust in the corner, paKet will run on that just fine. Packet radio is an excellent application for the older systems that are not much use for anything else nowadays, so It is quite feasible to dedicate an older system to running paKet 24 hours per day. What else do we do with those older systems now? We used to give them to the wife or children to use as a word processor, play games, etc., but many modern word processors need at least 4MB RAM, 10 to 20 MB of disk, 80386, etc. . . . the good games are not much better. Thank goodness for packet radio! If you are running Windows, OS/2, DESQview, etc., you will find paKet runs quite happily in the background as a simple DOS task. In addition to providing the usual Terminal Mode where you can send and receive data via the TNC, the program provides many features and facilities to enhance the operation of your packet radio system. Such features include:

- Full Personal Message System with automatic Mail Forwarding to the BBS

• Flashback feature to review earlier communications
• Disk and/or printer logging
• ASCII text file transfers
• Exchange computer programs and other disk files with: paKet-Protocol, an advanced Binary File Transfer protocol YAPP Binary File transfer protocol BayCom Binary File transfers (Digicom supported too)
• Full online TNC help for your TNC commands
• Online Manual—this entire Manual is available in a pop-up window
• Interrupt driven communications, so you don't lose anything even when paKet is running in a multi tasking environment.
• Runs on COM1, COM2, COM3 or COM4
• Both Hardware and Software Handshaking supported
• Multiple windows for up to 10 simultaneous connections
• REMOTE Mode—(unattended access)
• Access to DOS, your favorite editor, and file LISTer from within paKet
• Automatic Script processing . . . etc., etc., etc.

PaKet is fully configurable so you can customize a system especially to suit yourself. Setting up your system is but a matter of a few keystrokes. It will run with any TAPR-compatible TNC, and that includes just about all TNCs on the market today.

Super Morse version 4.15
SM415.EXE

This is the latest version around of the premier Morse trainer program. The author, M. Lee Murrah, has created a program that teaches Morse as a foreign language, not just as disconnected sounds or letters. Supporting SoundBlaster compatible audio cards, capable of running under Windows, this is one very nice way to learn Morse.

EzPacket version 17a
EZPKT17A.ZIP

Frank Domina N9MXI used the code written by Andrew C. Payne for the Poor Man's Packet (PMP) modem as a model for this program. With more than 95% of EzPacket being written from scratch, he hopes to replace the few bits left for low-level bit I/O in the next version.

The author feels this program is friendlier than the original PMP software, while offering more features. I leave it to you all to decide.

Frequently Asked Questions
FAQ-PAK.TXT

Picked up on the Internet, this is a text file which answers just about every question I've ever been asked about packet, including a few that I have asked myself. For many of you, this might even beat $10 bucks for a book!

A2Fterm version 3.01
A2FTERM.BXY

With some anticipation, I am including this program, A2Fterm, an Apple IIE, //e, IIC terminal software for packet radio, PacTOR, AmTOR, etc. Featuring multiple screens using HOST mode with Kantronics TNC's. Contest features. Macros. File transmit/receive. Relay received data on one stream to another. "Brags." Operate PacTOR/other HF modes while operating VHF packet at same time with KAM. Usable with all TNCs. Does NOT operate on Apple II, II+ or IIGS nor on Apple clones. ShrinkIt (3.4) archive. Please note that this is an APPLE program on an IBM PC disk! If you want this program on your Apple, you will need a friend with a PC to transfer it to you.

"So there you have it. A variety of gifts, ranging from two bucks up, with something in there sure to satisfy the pickiest among us."

So there you have it. A variety of gifts, ranging from two bucks up, with something in there sure to satisfy the pickiest among us. Now, all you have to do is leave this issue of *73* lying open on the kitchen table, with a strategically placed circle or sticky note, and let the family take it from there! To receive any or all of the now seven disks in the "RTTY Loop" disk collection, send a self-addressed stamped envelope or E-mail message to me for the list of programs on each disk. Each disk collection is over 1.2 Mb of material, and will fit comfortably on a 1.4 Mb 3.5" PC compatible disk. Just send sufficient disks for the collections you want, $2 in US funds for each disk to be filled, and a self-addressed, stamped disk mailer to return the disks to you, to the address at the top of the column.

As I look for your comments and questions, to the above SnailMail address, or via CompuServe 75036,2501; Delphi MarcWA3AJR; America Online MarcWA3AJR; or Internet MarcWA3AJR@aol.com—my family and I extend to your and yours the best for this holiday season, with health and happiness for all. See ya next year!

Number 17 on your Feedback card

PACKET & COMPUTERS

Jeffrey Sloman N1EWO
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Potluck

September was an incredibly busy month here. That's why you didn't see anything from me last month. (There is a two-month lag between writing and publishing.) I am barely recovered from the frenzy, so this month I am going to cover a variety of smaller items that get overlooked.

Contacting Me

I apologize at the outset to my regular readers who have seen some ol this information before. On the other hand, don't skip this section because you'll find a new E-mail address in here. There are three ways to reach me (and I am always glad to hear from youl):

Electronic Mail

This is the best way to get in touch with me. The address is:

n1ewo@iquest.net

and it can be used for any sort of communication. Comments and questions concerning the column, greetings, etc., are all OK here. Though you may find me listed on other services (CompuServe, AOL, BIX, MCI, etc.), I will NOT answer mail to those addresses. The IQuest address is reachable lrom anywhere on the Internet, and from any of the other services on which you will find me as a user. So, if you want an answer, use n1ewo@iquest.net.

Paper Mail

For those of you without E-mail access (you have got to change thatl), paper mail care of the magazine (address at the top of this column) will do. Once again, any sort of question or comment is fine by this route. I answer paper mail as I have the time. I try to answer it all, but you guys like to write and sometimes I cannot handle the volume.

Packet Mail

I am very pleased to be the first packet mail contact for many of my readers. Messages saying hello are always welcome, and I enjoy responding to let you know that I got your traffic. However, I simply cannot respond to packet mail that asks questions about the magazine or column—I cannot do business over ham radio. Please do not send me such mail—it is very frustrating; I cannot answer it. If you'd like to send a greeting, though, use:

N1EWO@NØARY.#NOCAL.CA.USA.NOAM

(Note: I am NOT in California; the NØARY gateway forwards mail from the AX.25 network to and from the Internet. If you are interested in this service, send mail to BBS@ARA-SMITH.COM with any contact and you'll receive instructions.)

NA vs. NOAM

I got quite a response to my suggestion that you avoid the .NA ending to hierarchical addresses. To refresh your memory, I pointed out that .NA is the Internet specification for Namibial The people in Namibia are not too pleased to handle traffic mistakenly routed there. The correct ending tor North America is .NOAM, but it seems that many sysops do not have their BBSs configured to handle .NOAM. The result is that if you (correctly) address your North American-bound mail with .NOAM, it will sit on the BBS until the sysop changes it to .NA. The best strategy is probably just lo leave that part of the address off completely, and let the sysop deal with it—the mail will probably make it.

The Internet

It is about time that each of you finds a way to access the Internet. I am not just talking about E-mail, i am talking about a full-fledged SLIP (Serial Line Internet Protocol) connection that puts your machine on the Net. Here's how it works: With a SLIP connection you use special software to treat your modem as if it were a NIC (Network Interface Card). With this software in place, you call up a router—this could be a dedicated box which does nothing else or a port on a host that also supports logins—this depends on your Internet provider's configuration.

Once this connection is made, your machine—the PC on your desk—is actually on the Internet, the same way any host out there Is. So what can you do? Anything that can be done on the Net. This includes the obvious, like E-mail, and many utilities that we have discussed here in the coverage of JNOS, like finger, ftp, etc. It also includes exciting things like WWW (World Wide Web). WWW is a graphical, hypertext-based way to find and use information out on the Net. The most popular implementations run under Windows, and you can spend hours looking around with a WWW client.

How do you get connected? That depends upon where you are. There are many Internet Providers across the country, some local, some regional, some national. A local or regional provider has the potential to be a better deal, and you'll probably find people you know using the service. A couple ol examples of outstanding providers: If you are in Indiana, a company called IQuest Internet offers very low cost (about $15/120 hours/month) SLIP. I am currently using IOuest for my own Internet connectivity and am quite pleased. In Massachusetts there is a company called Software Tool & Die. These folks have been around for quite a while and recently upgraded their host. I know quite a few satisfied users of STD's "World" host and their fees are reasonable. In New York, check out Panix, which is similar to these other two. There are many Internet providers out there; you'll need to talk lo users about the service they have received to determine il the provider you are interested in is a good deal. Il you are currently using a local/regional provider that you like, drop me a line to n1ewo@iquest.net and let me know—I'll mention it here.

"A local or regional provider has the potential to be a better deal, and you'll probably find people you know using the service."

That's it for this month—next month I'll be ramped back up into a full-length column. Until then, I look forward to hearing from you. 73 de N1EWO.

Number 18 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041

Single-Band Wideband Receiver Preamplifiers

If your HF receiver is a bit marginal on one or more bands, or if you build home-brew "minimalist" receivers (such as direct conversion receivers), then it is possible that the sensitivity is not up to snuff. The sensitivity problem for manufactured receivers is usually seen on older, low-cost models. Direct conversion receivers (DCR) sometimes suffer from sensitivity problems, especially those models that have considerable mixer loss (not usually a problem on NE-602 designs used by many hams, but often a problem with diode double-balanced mixers).

One possible solution to these problems is the use of a wideband preamplifier. However, if the "wide" part of wideband is too great, then it is possible that you will create as many problems as you solve. The wideband preamplifiers will see all signals within its passband, and this may affect dynamic range or otherwise overload the front end of the receiver. This can especially be a problem with diode mixer DCRs, even those that use a single LC resonant circuit between the antenna and the mixer input. If the problem is only on a single band, then it's possible to overcome the induced overload problem by limiting the bandwidth of the preamplifier.

This month we'll take a look at a single-band wideband amplifier based on the MAR-x series of RF integrated circuits. I first used this project in an article in a magazine dedicated to scanner/SWLs for antennas for Jupiter reception. That application requires an 18-to-24 MHz bandwidth. One reader wrote to me and told me of using the preamplifier for his home-brew 15 meter ham band receiver used in "mountain topping" and other QRP applications. That idea struck a resonant chord!

Figure 1 shows the circuit for the single-band preamplifier. It consists of a wideband MAR-x amplifier IC preceded by a high-pass filter and a low-pass filter in series. The MAR-x devices are made by Mini-Circuits of Brooklyn, New York, and are available in small quantities from Ocean State Electronics (6 Industrial Drive, Westerly, RI 02891; 401-596-3080). There are two MAR-x devices that are generally useful in this application. The MAR-1 is used from near-DC to 1,000 MHz with 18 dB gain in the lower frequencies and has a noise figure around 5 dB. The MAR-6 is a low-noise variant that operates to 2,000 MHz with gains to 20 dB in the lower frequencies with a noise figure of 2.8 dB. Both devices use the pinouts shown in Figure 1.

"The wideband preamplifiers will see all signals within its passband, and this may affect dynamic range or otherwise overload the front end of the receiver."

On all of the MAR-x devices the input is pin no. 1, and is identified by a color dot (brown on MAR-1 and white on MAR-6) and a bevel on the lead itself. The output is pin no. 3, while both pins 2 and 4 are grounds.

The DC power supply is connected to the output pin through a resistor and an optional RF choke (RFC1). The MAR-1 wants to see +5 VDC @ 17 mA and the MAR-6 wants to see +3.5 VDC @ 16 mA. The DC voltage regulator in Fig. 1 (i.e. U2) should be a 78L06 for MAR-1 circuits, and 78L05 for MAR-6 circuits. Both of these are available either under the part numbers (78L05 and 78L06), or as replacement part numbers from service replacement lines such as NTE and ECG. Ocean State Electronics carries the NTE Semiconductors replacement line [Note: 78L05 = NTE-977 and 78L06 = NTE-988].

The value of resistor R1 depends on the regulator and MAR-x device used. For either case:

$$R1\ (\text{ohms}) = V_o - V/I_{mA} \times 1{,}000$$

Where:

R1 is the value of resistor R1 in ohms;

V_o is the output voltage of U2

V is the preferred terminal voltage of U1.

Equation [1] evaluates to 58 ohms for the MAR-1 conditions (use 56 ohms), and 88 ohms for MAR-6 conditions (use 91 ohms).

A printed circuit pattern for the circuit of Figure 1 is shown in Figure 2. If you don't want to bother making your own board, then you may order one from FAR Circuits (18N640 Field Court, Dundee IL 60118) for $4.75 plus $1.50 S & H per order.

The input circuit for the MAR-x device is a low-pass filter in series with a high-pass filter. The values for the inductors and capacitors are found from tables in *The ARRL Handbook for Radio Amateurs.* A limited set of these values (for 1 dB ripple factor) is:

$L1 = K1/F_{MHz}$	=	$17/F_{MHz}$ µH
$L2 = K2/F_{MHz}$	=	$24/F_{MHz}$ µH
$L3 = K1/F_{MHz}$	=	$17/F_{MHz}$ µH
$L4 = K3/F_{MHz}$	=	$7.3/F_{MHz}$ µH
$C1 = K4/F_{MHz}$	=	$3473/F_{MHz}$ pF
$C2 = K4/F_{MHz}$	=	$3473/F_{MHz}$ pF
$C3 = K5/F_{MHz}$	=	$2776/F_{MHz}$ pF
$C4 = K6/F_{MHz}$	=	$1662/F_{MHz}$ pF
$C5 = K5/F_{MHz}$	=	$2776/F_{MHz}$ pF

If you want to build for 0.1 dB or 0.01 dB ripple, then see the *ARRL Handbook* for the K values. The inductors are made on toroid cores. Use either the T-50-2 or T-50-6, and wind the cores with enameled wire. The number of turns is found from:

$$N = 100\sqrt{L_{\mu H}/A_l}$$

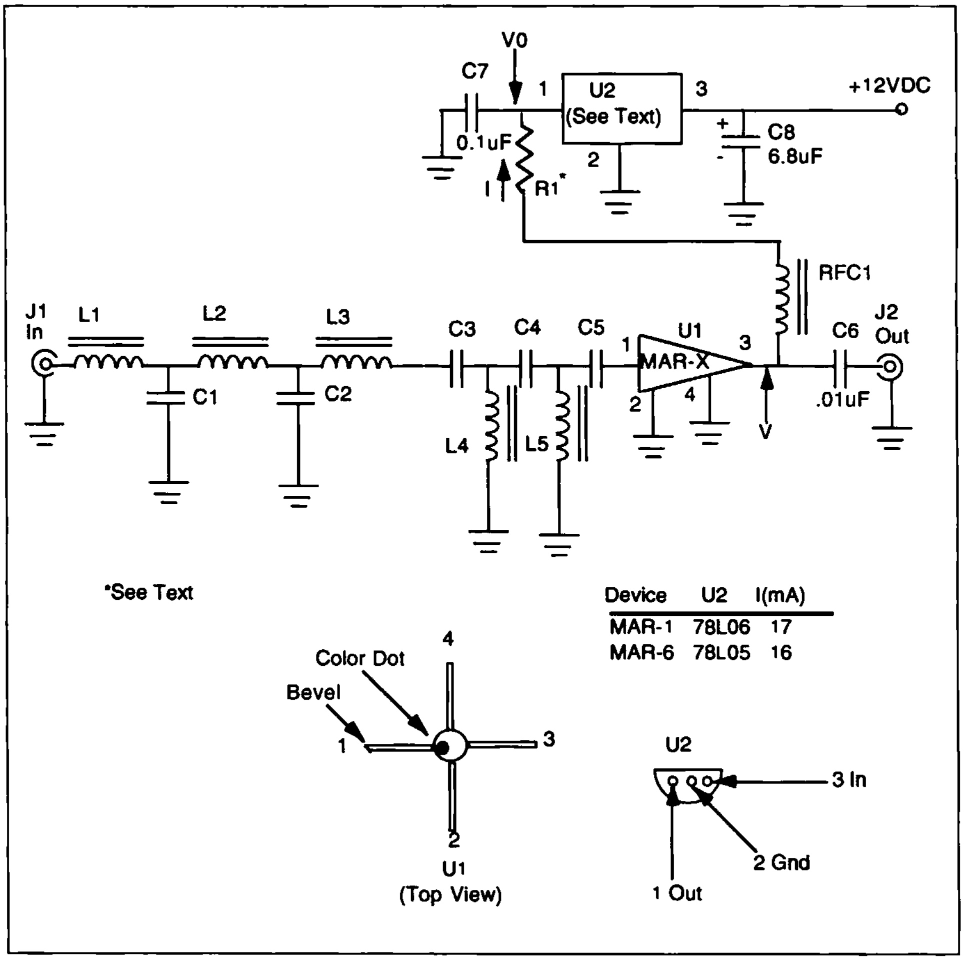


Figure 1. Circuit for single-band preamplifiers.

Where:

N is the number of turns;

$L_{\mu H}$ is the required inductance in microhenrys;

A_L is a property of the toroidal core (49 for T-50-2 and 40 for T-50-6).

The last coil in the circuit (RFC1) is actually used as a peaking coil to improve the bandwidth. This coil should have an inductive reactance about four times the output impedance at the lowest frequency of operation. Because both input and output impedances on the MAR-x devices is 50 ohms, the inductive reactance of RFC1 should be on the order of 200 ohms (but the precise value is not terribly critical). Find the inductance from:

$$L_{\mu H} = 200\ \text{ohms}/2\pi F_{MHz}$$

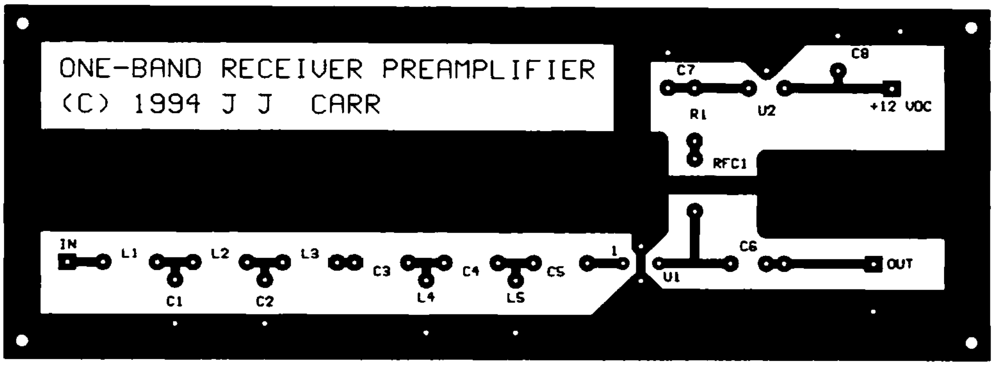


Figure 2. Printed circuit pattern for the circuit shown in Figure 1.

For example, for a 14 MHz receiver this equation evaluates to 2.3 fH. If a T-50-2 toroid core is used to make this coil, then 22 turns of wire are required.

Conclusion

The single-band receiver preamplifier will go a long way towards boosting the poor performance of marginal receivers. It is easy to build, and behaves quite nicely. ■

QRP

Number 19 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

With the coming of winter, the days are shorter and the nights are longer, just perfect for some late-night QRP-ing. But, sometimes you're just not in the mood. Well, instead of talking your wife into letting you go to the next hamfest, how about firing up the word processor for some letter writing? I've compiled a list of current ORP clubs. This is the most complete list I've been able to compile.

QRP ARCI, c/o Mike Bryce WB8VGE, 2225 Mayflower NW, Massillon OH 44647. $12 for new membership, $10 for renewal, $2 for info package.

CW Operators QRP Club, c/o Kevin Zietz VK5AKZ, 41 Tobruke Ave, St. Marys SA 5042 Australia. $14 for US membership.

G-QRP Club, c/o Mike Kilgore KG5F, 2046 Ash Hill Road, Carrollton TX 75007. $12 for US membership.

Michigan QRP Club, 654 Georgia, Marysville MI 48040. $7 for new US membership.

The Northwest QRP Club, Bill Todd N7MFB, 2418 55th Ave S.W., Seattle WA 98116. $10 for new members.

The QRP Club of New England, Jack Frake NG1G, P.O. Box 1153, Barnard VT 05031. $10 for new US members.

U-QRP Club, P.O. Box 100, Saransk-31 Russia 430031. Unknown membership; newsletter is in Russian.

NorCal QRP Club, Jim Gates WA6GER, 3241 Eastwood Road, Sacramento CA 95821. $5 for US membership.

K5FO QRP Newsletter, Chuck Adams, Twilight Publishing Co., 1301 Highway 407, Suite #353, Lewisville TX 75067. $10 for 12 issues.

St. Louis QRP Club, Keith Arns KCØPP, 2832 PenBrooke Lane, St. Charles, MO 63301. Dues are unknown at this time.

Oklahoma QRP Club, OK QRP Group, Don Kelly, Editor, 703 West 8th Street Edmond OK 73003. No dues, but $10 donation helps the club out.

EA QRP CLUB, c/o Sr. Miguel Molina, Avenia Rio De Janeiro 123 2-1 08016 Barcelona, Spain. No kidding, the newsletter is in Spanish.

OK QRP CLUB, c/o OK1CZ, Petr Doudera, U 1.Baterie 1, 16200 Praha 6, Czech Republic. 15 IRCs or $10 dues. The newsletter has English translations for the most of the text.

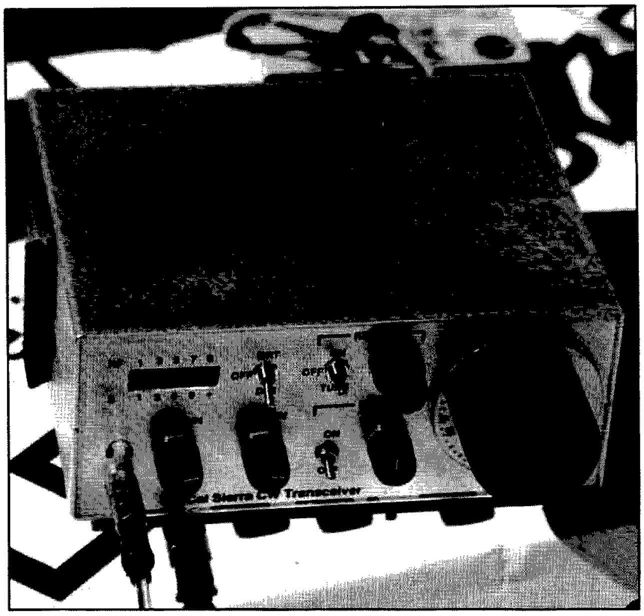


Photo A. The NorCal Sierra multiband transceiver.

WI QRP Club, P.O. Box 111, Brandon WI 53919-0111. Dues suggested: $5-$10.

Central Pennsylvania QRP Society, Cameron Bailey KT3A, P. O. Box 173, Mount Wolfe PA 17347.

Colorado QRP Club, Rich High WØHEP, 14261 East 4th Avenue #161, Aurora CO 80011-8711.

There, that should keep you busy!

Home-Brew

If you've been thinking of a late-winter project, I've got two you may be interested in. Both are transceivers you can build for either 30 or 40 meters. The first one is the 40-40 rig made possible by the New England QRP Club. Late word has it the 40-40 is also available on 80 meters, and a 160 meter version is on the drawing board. The rig is on a single-sided PC board. This one board contains both the superhet receiver with a crystal filter and the 2 watt transmitter. Full electronic QSK is used for T/R control. The entire rig can be put inside your shirt pocket. The 40-40 was designed by Dave Benson NN1G. Kits are available from Dave for $43, at 80 East Robbins Ave., Newington CT 06111.

What's unusual about this rig is the lack of an IF amplifier. From the mixer, the signal is routed through the crystal filter, and then directly to the BFO. There's plenty of gain in the chain for weak signal work, and without the hassle of tuning the IF for the correct peak. Only two crystals are used in the IF filter, but they are plenty narrow for CW work. Adding an extra crystal in such a simple rig does not increase the selectivity of the rig so much that most of us can hear.

Another important feature of the 40-40 is the way the tuning is accomplished. Instead of the usual variable capacitor, a varactor is used. A stable reference voltage is applied to the varactor via the front-mounted 100k tuning pot. This scheme works quite well. My first attempt, however, did not fly—out of the junk box came a 100k pot all right, but it had an audio taper instead of the required log taper. With this pot, the rig proved almost unusable. Use the proper taper on the tuning pot.

The 40-40 lacks two other fea-

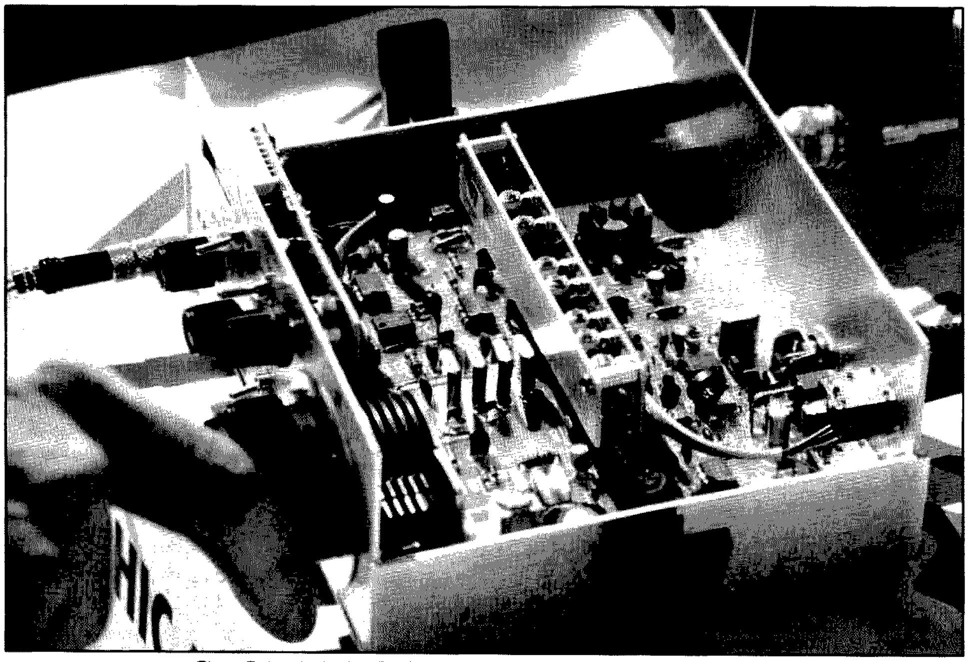


Photo B. Inside the NorCal Sierra. The plug-in band module is in the center.

tures—a RIT and an AGC. You ride the volume control to keep strong signals from overloading the receiver. Adding a RIT control *is* possible, and I'll have some more details soon.

Another rig you'll be hearing a lot about is the Sierra from the NorCal group. The Sierra is the brain work of Wayne Burdick N6KR This is an all band rig using plug in band modules. Operation from 160 meters through 10 will be possible, with the proper band module. This rig is a bit more complex that what we've seen coming from the NorCal group. It's a double-sided board with plated through holes. I've been told there's even gold plating on the band module fingers. It looks like a first class rig. I've not been able to get my hands on one, as they are still in the *get the bugs out* stage of development. I've included some photos of the rig, inside and out, so you can see what you'll be up against.

Bil Paul KD6JUI took a Serria out for some bicycle mobile/hiking. Bil writes:

"Ten touring bicyclists, most of whom had never met one another, met at Crescent Lake, Oregon, on August 27 to ride a portion of the Pacific Crest Bicycle Trail for a week. Among them were two women, two Germans and four hams.

Photo C. The Pacific Crest Bike Tour. Clockwise, beginning at upper left: Russell Dwarshuis KB8U, Gottfried Kloyer DLZMFJ/AA1JQ, Cory Mitchum, Liz Burke, Jan Maurer, Rich Lesnik, Tom Hook, Dan Arbogast NØDA, Bil Paul KD6JUI, and Dan Ogilvie.

"The hams, Dan Arbogast NØDA of Corvallis, Oregon; Russell Dwarshuis KB8U of Ann Arbor, Michican; Gottfeied Kloyer DL2JUI of Wessling, Germany; and trip organizer Bil Paul KD6JUI of Dan Mateo, California; operated QRP HF from campgrounds along the way, as well as keeping 2 meter communications between slow and fast groups, and between groups taking slightly different routes.

"Dan Arbogast worked mostly 2 meter packet, while the other hams worked mostly 40 meter CW QRP, with some success: Japan, Alaska, Hawaii, Canada, and all the Pacific Coast states were worked.

"Antennas used were a 40 meter inverted V, a 20 meter end-fed dipole, a 40 meter half-wave vertical and a 40 meter ham stick mounted on a recumbent bicycle. Power in most cases was provided by solar cells. Paul successfully field-tests a prototype Sierra QRP rig being readied for its members by the Northern California QRP Club.

"Combining beautiful scenery with hamming, camping, rigorous bicycling (the cyclists climbed a cumulative 14,000' over a week) was a potent thrill for all radio amateurs involved."

Number 20 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Where in the World are Geography Resources for Teachers?

"Okay, kids, now open up your geography books and let's read about the topography and climate of Ecuador." Students who are lucky enough to be in a classroom with a ham radio will never have to be subjected to this kind of introduction to a geography lesson.

Gone are the days when geography in a classroom referred only to the ability of students to spot places on a globe, or to mentally match cities with countries, or capitals with states. Sadly, many people have the perception that geography is about the location of specific places. As citizens of an "ever-shrinking" world, we can no longer afford to present a one-dimensional view of geography to our children.

Geography should be taught as a way of interpreting the world around us. Geography is an on-going phenomenon involved with history, culture, and a country's contemporary problems. Amateur radio in the classroom allows the teacher to teach geography on a need-to-know basis. My classroom is set up in a way that allows easy access to wall maps, globes, and atlases. The students are always eager to point to the spot on the map where the voice on the radio is coming from.

There are many resources for the teacher of geography. Be sure to avail yourself of only the most current materials. Geography belongs as an integral part of the amateur radio curriculum for youngsters. An attractive QSL card from some faraway place, or a souvenir or snapshot from another state, can trigger off an entire social studies unit. The teacher who uses the radio must be flexible and ready at all times to respond to the interests and needs of the students.

Very often, I work with the social studies teachers at my school to better coordinate a really stimulating introductory session or to follow up a geography lesson in a meaningful way. The sixth-, seventh- and eighth-grade social studies students look forward to visiting the ham radio room. They know that they may not always make the contact we're looking for, but they also know that we'll probably meet someone new and different and that they will definitely have a fun time.

A group of social studies teachers and I put together this list of geography resources. Be sure to let me know about successes you've had with the creative use of amateur radio in the teaching of geography skills.


Photo A. Students should enjoy learning about the world around them.

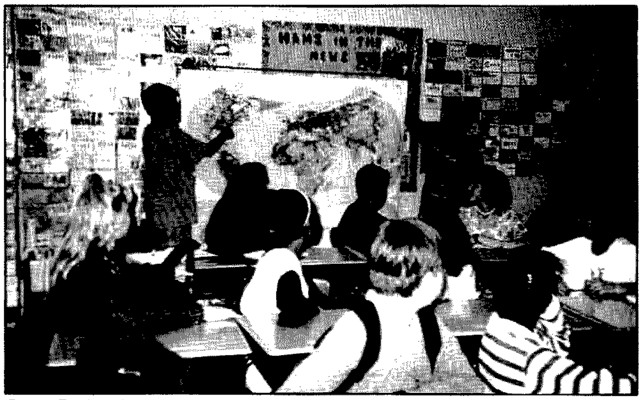


Photo B. Kids like to go to the wall map to pinpoint the location of the voice on the radio.

The Geography Education National Implementation Project

The following booklets on *Guidelines for Geographic Education: Elementary and Secondary Schools* are published by the Geography Education National Implementation Project in cooperation with Rand McNally & Co. To order, contact the National Council on Geographic Education, Indiana University of Pennsylvania, Indiana PA 15705, or call (412) 357-6290; *K-6 Geography: Themes, Key Ideas, and Learning Opportunities*, 1987, $6. This booklet addresses levels of thinking and dimensions of content for elementary students.

7-12 Geography: Themes, Key Ideas, and Learning Opportunities, 1989, $6. The secondary level volume provides a framework for developing courses of study.

Grades 4-6 students participating in National Geographic Kids Network use computers and telecommunications to learn geography with their peers worldwide. For information, contact the NGS's Educational Services Division, PO Box 98018, Washington, DC 20090 or call 1-800-368-2728.

The *1994 Geography Assessment Framework* (1992), developed to guide the NAEP Geography Assessment in 1994, is an extremely valuable instructional resource for teachers. Strongly influenced by public concern about our nation's geographic ignorance, it is constructed with one guiding question foremost in mind: "What fundamental geographic knowledge, understanding, and applications should students have mastered in order to be informed and productive 21st century citizens?" It clearly explains the dynamics of geography education and provides sample questions and objectives to illustrate the cumulative nature of geographic learning. Copies are available from the National Assessment Governing Board, 800 N. Capitol St., N.W., 8th floor, Washington DC 20001.

General Reading

Don't Know Much About Geography by Kenneth Davis tells us fascinating facts about the world in an amusing yet extremely informative way. Published by Avon Books, NY; $11.

The Real World: Understanding the Modern World through the New Geography, 1991; $35; Houghton Mifflin Co. Students will love the beautiful photos. It addresses basic questions about the physical and social aspects of the contemporary world.

For parents: *Helping Your Child Learn Geography*, 1990, 50 cents. Order from: Consumer Information Center, Dept. 414Y, Pueblo CO 81009. By Carol Sue Fromboluti, this booklet provides games and activities for ages 10 and under.

Resource Places: National Geographic Society, 17th and M Streets, N.W., Washington DC 20036; Association of American Geographers, 1710 16th Street, N.W. Washington DC 20009.

Please be on the lookout for enthusiastic and articulate youngsters who would like to be interviewed for participation in the Dayton '95 Youth Forum. Have them contact me at (718) 983-1416.

HOMING IN

Number 21 on your Feedback card

Radio Direction Finding

Joe Moell P.E. KØOV
P.O. Box 2508
Fullerton CA 92633

T-Hunting Down Under

December already! Another year is almost over. Are you going to let 1994 end without experiencing at least one hidden transmitter hunt? If my correspondence is any indication, 1994 has been the busiest year yet for radio direction finding (RDF) enthusiasts. In large cities and small towns, hams are discovering the fun of these contests, which are sometimes called foxhunts or T-hunts.

In many parts of the USA and Canada, cold weather has halted foxhunts until spring. In some cities, such as Montreal, snowy weather is no deterrent, and regular hunts continue. With no snow or freezing weather here in the metropolitan parts of Southern California, we hold more than two dozen T-hunts every month of the year. Wintertime can bring heavy rains, but most hunters keep going like the famous battery bunny. All that is needed is a rainproof antenna installation and mud-ready tires.

A Fox on the Barbie?

There is at least one place in the world where a busy warm-weather T-hunting season is just getting started. As I learned in a recent exchange of messages on the Internet, transmitter tracking is becoming more and more popular as a ham activity in Australia. While there are occasional on-foot-only events there, most hunts involve mobiles and pedal-to-the-floor driving.

Bevin Boden VK5TV explained how a typical hunt goes (with my translation in parentheses): "All hounds (hunters) gather at one point and draw starting positions. The fox (hider) departs in his car and is given about 10 minutes start. After that, you are permitted to track and follow the mobile fox. After about another five minutes, the fox goes to ground (stops), sometimes putting the transmitter up a tree, in a bin down a manhole, and so forth.

"After a lot of speeding around with funny-looking aerials, the first hounds arrive. If the fox is in a car parked on the road, it is a quick identification and wait until the next hunt starts. If not, it is out with the sniffer (hand-held RDF) gear and try to find the wretched fox. Sometimes half an hour of people running around like chooks (chickens) with their heads' cut off goes by before the fox is found. The fox has even been one of the hounds in disguise, waving a beam around and supplying strong signals to individual hounds at will."

Sometimes there are several hunts in one evening. It is traditional for the fox team to provide food and drinks for all the hunters after the last round. At this gathering, results are tallied and winners are announced.

The high point of the year for Australian T-hunters is the annual South East Radio Group convention in Mt. Gambier, which includes the annual Australian Foxhunting Championships. "Some hams travel more than 1,500 miles to attend," says VK5TV.

Mark Diggins VK3JMD sent a copy of the itinerary and rules for the 1994 championships. There were 11 separate events over a 26-hour period, including sniffer hunts, mobile outings, and even a special on-foot foxhunt just for kids. Mobile hunters had an opportunity to track beacons on ham bands from 3.5 to 1200 MHz. The winner of every hunt was determined by elapsed time, first finder wins. No hunts were scored by odometer mileage, as is often done stateside.

The biggest challenge of the championship weekend was Saturday at 8 p.m., when the marathon four-band night hunt began. Foxes keyed down on 2 meters, 10 meters, 70 centimeters, and 6 meters. Marshals kept close watch to ensure that the rules were obeyed. Special rules were crafted with careful attention to detail. For example, one rule stated, "Should it be necessary to leave the vehicle, only one set of RDF equipment is permitted amongst the group from that vehicle. This includes foil under T-shirts."

Information on the championships was just part of the information package that VK3JMD sent about VK-land T-hunting. It also included photos and videos of Aussie hunters in action. Mark lives in Dingley, which is in Victoria, at the southern tip of eastern Australia. He is close to Melbourne, the apparent capital of T-hunting for the country. His club, the North East Radio Group (NERG) is very active in promoting the sport.

Photo A. Mark Diggins VK3JMD sent these photos of T-hunting in Australia. His sweatshirt (a "wind-cheater," as the Aussies call it) features his original foxhunting graphics.

NERG member Andrew McColm VK3KIR produced the video to show non-hunters how it's done there. In it, Geoff Hudson VK3VR tells some of his secrets of success on first-finder-wins hunts. He urges new hunters to start turning their beams and getting bearings as soon as the fox drives away. "If he's been gone 10 minutes and he's as weak as water, the signal will be masked by many reflections and you won't have a clue which way to head."

VK3VR continues, "As you drive out, stick on major roads. For heav-

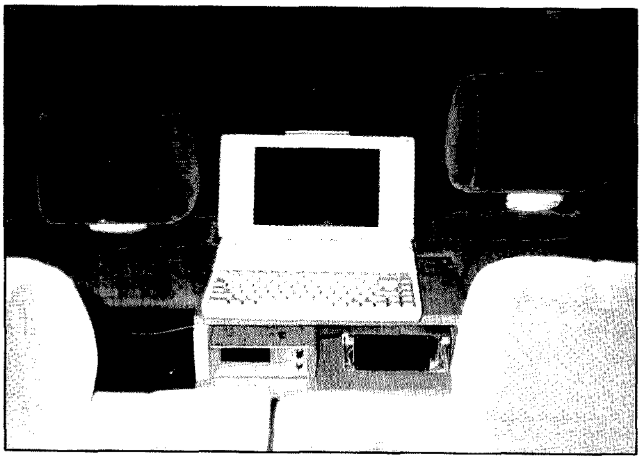


Photo B. The back-seat navigater on Mark's team uses this computer to plot signal strength readings. His Doppler DF display is underneath.

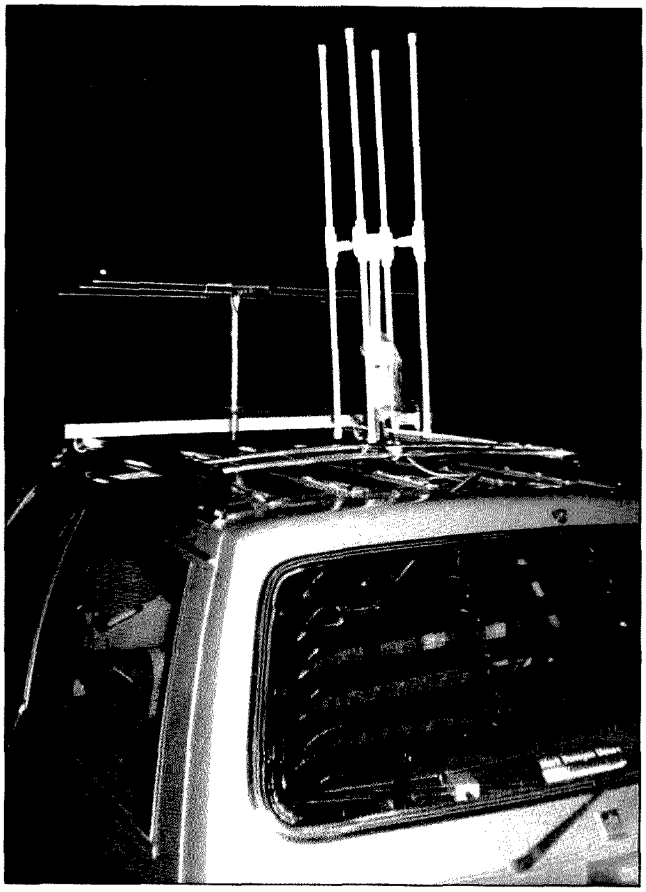


Photo C. The VK3GMZ team hunts on 2 meters with both a horizontally-polarized beam and a modified marine Doppler array.

Photo D. VK3CHR handles the controls for the VK3VT RDF team. The HF receiver operates directly on 10 meter hunts, and as a common intermediate-frequency system with downconverters for hunts on VHF bands.

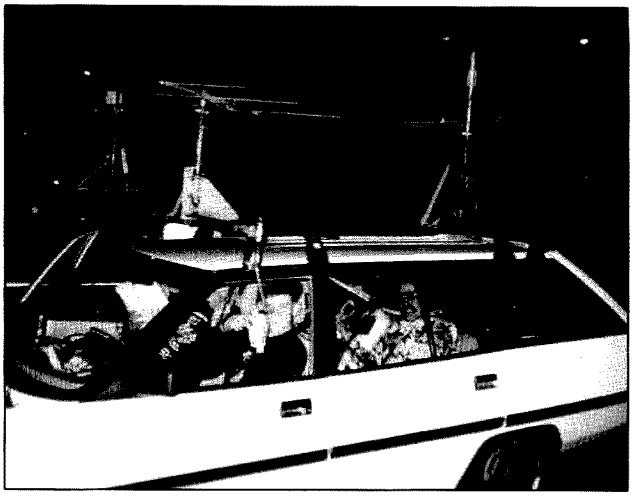


Photo E. A chain drive controls the horizontally-polarized beam for the VK3YQN team. They also have a motorized spinning quad and CRT display in back.

en's sake don't be pulled into side streets, they'll cut your speed dramatically. Use attenuation to reduce the overall system gain so that you can just hear the signal, thereby minimizing distracting reflections."

To save time on hunts where the fox is not right out on the road, back-seat team members jump out and take off on foot when they think they are within rapid hiking distance of the fox. This practice is called dropping runners. The front-seat hunters then continue, trying to drive closer.

"Don't be tempted to drop runners out purely on the basis of signal strength," Geoff urges. "Just because the signal's getting strong doesn't mean you're close. As you go by the fox, the signal will swing around. Wait until he's behind you—when you have gone past, you know you're close. Then drop your runners.

"If you don't have communication to your runners, agree with the guys what you're going to do if they don't succeed. We work on the basis that if a runner can't find the fox, he goes back to where the car dropped him off. Another tip for the runners is to always

Photo F. VK3XAJ heads down the road with his 10-element dual-polarized beam on the roof and scope-tube display in the back seat. "He gets lots of attention from the police," says Mark.

carry 30 cents for a phone call. At least you can phone for a taxi to get home if the buggers don't pick you up!"

Geoff went on to tell about the equipment you need to be prepared to home in, such as a sniffer and a torch (flashlight). Since radio foxes often hide on a riverbank, he carries an inflatable rubber dinghy and compressed gas cylinder in the car, in case his team drives up on the wrong side of the river. That ploy has been foiled, however, when hiders put the T on the bank in heavy brush with thorns.

Home-Brew Homers

When April and I visited down under a few years ago, most of the gear in almost every ham shack we visited was home-built. The Aussies' love of do-it-yourself continues, as you can tell from VK3JMD's Photos A through F. Commercial RDF sets are not readily available as they are in the USA, so each team has developed its own creative collection of mobile gear. Some are quite advanced, featuring motorized directional antennas, computers, and cathode-ray tube displays like those described in recent "Homing In" articles.

"Sniffers" for on-foot hunting usually consist of a sturdy three-element yagi and a receiver with built-in attenuation. A model by Ian Stirling VK3MZ, designed around the Motorola MC3362 receiver IC, is popular with home builders. Some hunters replace the receiver's analog S-meter with a voltage-controlled audio oscillator and speaker. The pitch of the oscillator's tone goes up and down in proportion to the signal level. They call them 'whoopee sniffers.' "

While some hunters employ VHF-FM receivers modified with external S-meters or multimode rigs in the sideband mode, most still prefer to build special RDF rigs. For instance, Greg Williams VK3VT crafted a set with tunable 6 to 8 MHz variable bandwidth IF, noise blanker, and calibrated S-meter in a shielded case. The ruggedly-built cabinet has a rotary RF step attenuator, but for even more signal reduction when very close it has a switch that open-circuits the antenna input. "Equipment really gets knocked around on a foxhunt," he says.

To encourage constructors, a home-brew competition with judging and prizes is part of the annual fox-hunting championships. There are three categories, novice through expert.

Many NERG foxhunts involve transmitters on three or four ham bands at the same time. With four members on his team, space in VK3JMD's vehicle is at a premium. He wants to replace his small 6 meter loop with a beam antenna for more gain, but he doesn't want to waste valuable hunting time assembling and disassembling the antenna in the field.

"The problem is storing antennas when not in use," he says. "In the back of the Subaru station wagon we carry four 2 meter sniffers, two beam poles, two 70cm sniffers, a 2 meter beam, 70 cm beam, 6 meter sniffer, toolbox, a box of spares, and some other personal stuff. If we add to this a full-size 6 meter quad, assuming we can get it in the car, we won't be able to move in our seats!" To solve the problem, Mark is now building a two-element "shrunken" quad. (See "Homing In," January 1990.)

Ski to the T

Though summer is coming to VK-land, foxhunters there don't dread the winter months. In fact, many look forward to T-hunting in the snow. VK3JMD's package included a flier on the upcoming SnowDF, which will take place at the Mt. Buller ski area. SnowDF is simply a series of 2 meter sniffer hunts in the snow.

Contestants can use any suitable means of human-powered travel on the slopes. Vehicles are prohibited, but hunters are allowed to use the ski lifts, if they can convince lift operators to let them on with arms full of RDF gear. Most entrants will hunt as individuals. Hunters may team up, but only one piece of RDF gear per team is permitted.

No hunt boundaries were mentioned on the SnowDF announcement, but it probably covers the entire ski zone, which is quite large. Organizers anticipate that many entrants will not be able to find all of the hidden Ts before dark. Their ordinary field-strength meter type sniffers may not be sensitive enough to get good bearings.

On the other hand, large RDF antennas are cumbersome when walking and skiing. Extra safety precautions will be in order when in the snow. Smart RDFers will use antenna elements that are designed to bend or break on impact, and include eye protection on the tips.

Bearing-taking in the snow will be a challenge. Snowbanks make good VHF signal reflectors. It has been our experience in Southern California that signal bounces from the mountains are always stronger in winter months when the peaks are snow-covered.

Many thanks to Mark, Bevin, and other RDFers who have sent information on local activities. As always, your T-hunting stories and photos are welcome. Send electronic mail to me via CompuServe (75236,2165) or Internet (joemoell@cup.portal.com). Send "snail mail" to the post office box in my byline.

RDF on the Information Superhighway

When it's 20 below and the snowdrifts are six feet deep, you may not feel like T-hunting in your car or on foot. But you can do the next best thing: Chat about T-hunting. Foxhunters across the country and around the world are online. You can sometimes find them on commercial services like CompuServe, but my favorite place is Fox-List on the Internet. It is sponsored by the Boston Amateur Radio Club and is free of charge, except for your usual E-mail access costs.

Unlike the Usenet ham radio newsgroups, where messages are posted for any Internet browser to see, Fox-List is a special mailing service called a reflector. After you join the list (subscribe), you automatically receive, at your e-mail address, copies of all messages sent by others to the Fox-List. To send a message to all other subscribers, you simply address it to fox-list@netcom.com. (The hyphen is important.) The server then resends it to all list members.

Fox-List is just like having a worldwide T-hunting BBS, with all postings sent to you automatically. So don't subscribe unless you want lots of messages filling your E-mailbox. Most exchanges are about the technical aspects of RDF. In recent weeks, there have been lively discussions on advanced Doppler techniques, East Coast versus West Coast foxhunting, and methods for computerized mapping for use with Global Positioning System receivers.

To become a subscriber, send a one-line E-mail message to listserv@netcom.com from the address where you want to receive your mail. The text is simply "subscribe fox-list" (without quote marks, of course). Then send a short message to fox-list@netcom.com to introduce yourself and describe your local RDF activities. When you see your message reflected back from the list, you will know that you are a member. ■

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ATV

Ham Television

ATV Wish List

Well, it's the time of year to think about all of that ATV gear you're going to get under the Christmas tree. I hope you've made it clear that any ATV stuff is a far better present than ties, shirts and sweaters! To help sway the odds in your favor, I've compiled a list of companies that offer ATV related equipment. You might want to leave this list laying around in an obvious place as a subtle hint. Don't be too blatant, you might end up with lumps of coal in your stockings. I'd be careful putting on your shoes and socks during the next few weeks.

Anyways, here's the goodie's list of companies that cater to the ATV enthusiast:

ATV Equipment

ATV Electronics
16807 N. 46th Lane
Glendale, AZ 85306
(602) 843-3585
Transmitter and Receiver boards and accessories.

CCTV Corp., GBC
315 Hudson St.
New York, NY 10013
(800) 221-2240
(212) 463-9758 FAX
Miniature TV cameras.

Communication Concepts, Inc.
508 Millstone Dr.
Beavercreek, OH 45434-5840
(513) 426-8600
(513) 429-3811 FAX
ATV downconverter and amplifier kits.

Down East Microwave
R.R. #1, Box 2310
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C. L. Houghton WB6IGP
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Microwave Test Equipment

I am always asked the question, "Why is it that microwave test equipment is so expensive?" Well, most of it was made by manufacturers like Hewlett Packard, Anarden, Anritsu, California Microwave and Frequency West. The initial price tag was quite high as a Mil-Spec item, and this pricing carries over to the surplus arena. Do not despair—these items can be duplicated in an amateur workbench setting in a few cases. The difference between our home-constructed unit and the commercial unit is mainly calibration.

Inexpensive surplus microwave items can be found, but most of the surplus dealers try to push the $$$ amount as far as it will go. That's part of the American way—free enterprise. I have always tried to find things for little or nothing, but even with surplus electronics there is a basic value (for scrap) that you can't go below.

The same goes for the surplus dealer. I am told many times in my bargaining and haggling over the final negotiable price that *"You can't romance a junk man!"* Be that at as it may, these dealers seem to know when you are trying to look the part of "Joe Cool" and in reality are quite excited about some item you discovered. They seem to be able to see the sparkle in your eye and set the price accordingly. All you can do is wear sunglasses or become a good pokerface. Look for bargains and price them as to how they can benefit you without your having to redesign the entire chassis.

Don't pick up microwave odds and ends without some plan of how to use them. Just because it's a microwave item, don't go head-over-heels for it. Set the proper pace—first determine if the item will fit in with your plan of construction. Of course, if the item is better than any other thing you have, pick it up if the price is reasonable. This is especially true of good mixers/detector mounts, amplifiers and miniature microwave relays. Other items require some thought. Even I take some of this advice and as such do not have a collection of waveguide attenuators. They're nice, but I only need one in the test setup I am about to describe.

Microwave Signal Generator

There are quite a few simple pieces that work well when assembled and form useful microwave test equipment. The general appearance of these items is not top-notch (finished) but perform their function well, are dependable and the cost is minimal. The little generator that I will describe is quite simple and is just about as effective as some of the very large microwave test generators. Its components are a Gunn oscillator, a waveguide attenuator and a coaxial transition. N6IZW and I both use this style test generator on our workbenches to retune circuitry for 10 GHz. Both low power (preamplifiers) and high power (10 watt TWT) amplifiers have been tested with this setup. My old HP 10 GHz signal generator (klystron generator) now sits idle and serves as the support for a shelf in the shack.

This little Gunn oscillator is quite useful in bench alignment tasks. When you stop and think about the 75 lbs. and unstable operation of klystron signal generators, this little adjunct will prove quite attractive. The beauty of this arrangement is that almost any type of Gunn oscillator will work just fine. All you need is some means of connecting a variable attenuator and a transition to a coax connector. Power for the Gunn oscillator can be a battery or a regulated power supply; I generally use my bench-regulated power supply.

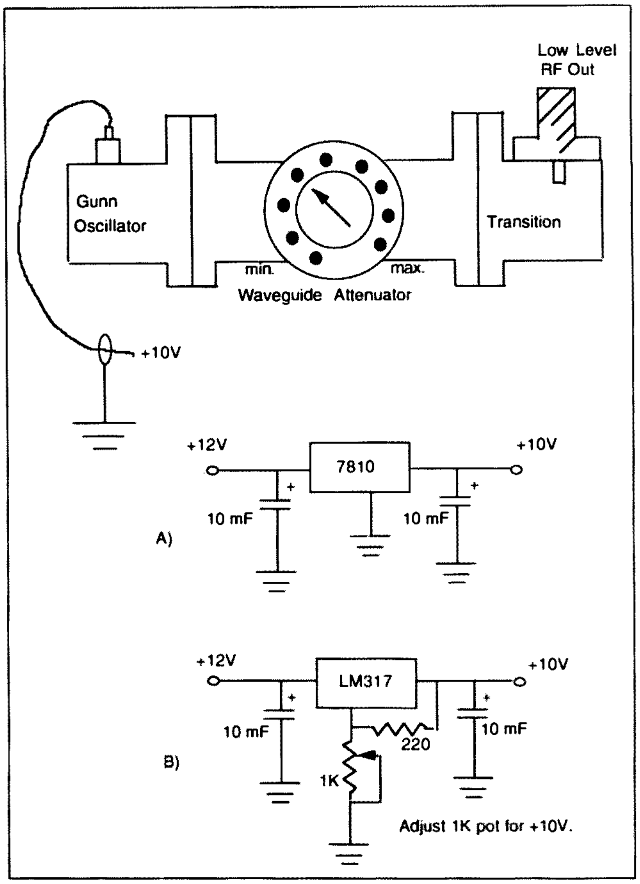


Figure 1. Microwave signal generator/Gunn oscillator power supplies: A) fixed voltage, B) variable.

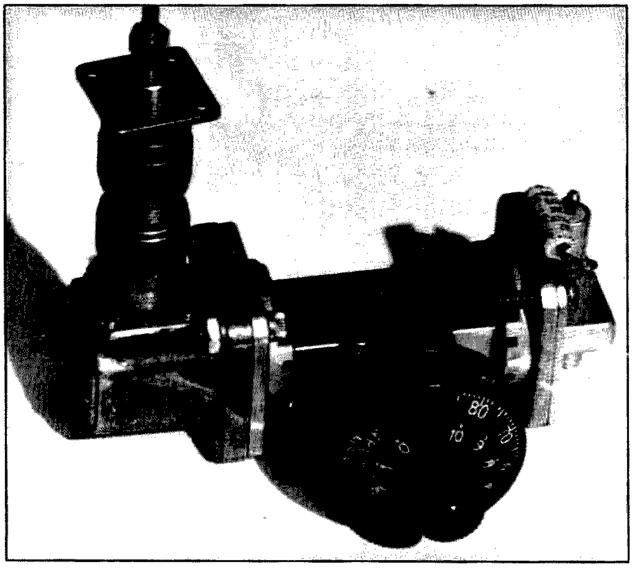


Photo A. WB6IGP's test generator.

The power supply is nothing more than a 9 or 10 volt regulated supply. See Figure 1 for power supply details. A fixed regulator could be used if 10 volts is all that is needed. Some readers might have a Gunn oscillator that requires a voltage of other than 10 volts and they can optimize their circuit with the adjustable LM-317 variable regulator circuit.

The heart of the generator is of course the Gunn oscillator, preferably a low power unit about 10 mW or less. Usually these oscillators use a waveguide flange and are equipped with a small horn antenna in burglar alarm systems. Our conversion is to remove the horn and attach a small waveguide variable attenuator in its place. The output of the attenuator is connected to a waveguide to coaxial transition. This connector on the transition will be our test generator output. Photo A shows my test generator—that's just how it was constructed many years ago. Variations in attenuator styles are not important; neither is their size. All that is required is that the attenuator be adjustable and have some means of calibration. A logging scale of some son is quite acceptable. All you want is to be able to reduce power to a very small amount (maximum attenuation) and not overdrive small signal amplifiers with this arrangement.

Cost of components should not be over $20 for everything. The Gunn oscillator can possibly be scrounged from a burglar alarm company for little or nothing. Check supermarkets and shopping center maintenance shops for door openers that are defective. The Gunn oscillators usually survive; toss the other PC board circuitry away. Waveguide attenuators are a drag on the surplus market and as such don't command a high price. After all, it won't amplify and, other than being scrap brass, it doesn't have much to offer. Three or four dollars seems tops for a good attenuator and adjustable mechanism. You might have to purchase some older WWII radar test set to obtain all the parts. Look around at swap meets and be frugal.

The transition from waveguide to coaxial should not cost more than five dollars in surplus. If you can't locate one, construct one out of a coaxial

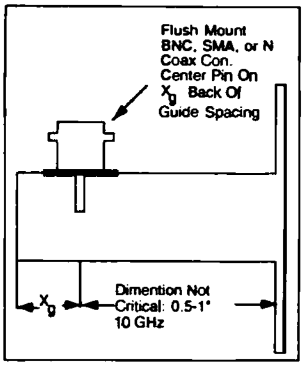


Figure 2. Waveguide transition. Xg = 1/4 guide wavelength at frequency. (10 GHz = 0.2")

connector and some scrap brass waveguide. Only an inch of waveguide (same size as the attenuator and Gunn waveguide flanges) is required. See Figure 2 for construction details; dimensions are not critical. Position the coaxial connector on top of the waveguide section with the rear of the connector shoulder just about at the end of the waveguide. Note where the center conductor is located on the top of the guide and drill a large hole to accommodate the connector sitting flush on top of the waveguide.

Drop in your "N" connector and solder to the top of the guide (other connectors are suitable). Place a brass plate on the rear of the waveguide to close off the end of the guide and solder it into place. We want this end of the waveguide to be closed off with the center connector of the coaxial connector spaced 1/4 wavelength from this rear wall, which is a shorted piece of waveguide (read or end of the guide). The front of the guide—the open section—is fitted with a small brass flange which is soldered into place over the end of the open waveguide. Keep solder out of the inside of the waveguide as much as possible as it's is very lossy at microwave frequencies. Finish off the front of the transition by making the waveguide Flange constructed "FLAT."

Don't use a file for other than rough finish of this section of waveguide. It is very important to have close tolerance waveguide sections butting up to each other without small cracks—the microwave RF will leak out of poorly-fitted flanges. To make the flange flat, place some medium sand or emery paper on a small piece of glass and rub the face of the flange on the emery-papered surface. In a very short time you'll see high and low spots that need further attention before it becomes flat. In no time at all it will look quite flat and somewhat polished. The Glass flat I use is 6" square and 1/4" thick. I used a thick piece of scrap so the small glass would not be very fragile. Back up the glass with a piece of wood or newspaper on a tabletop.

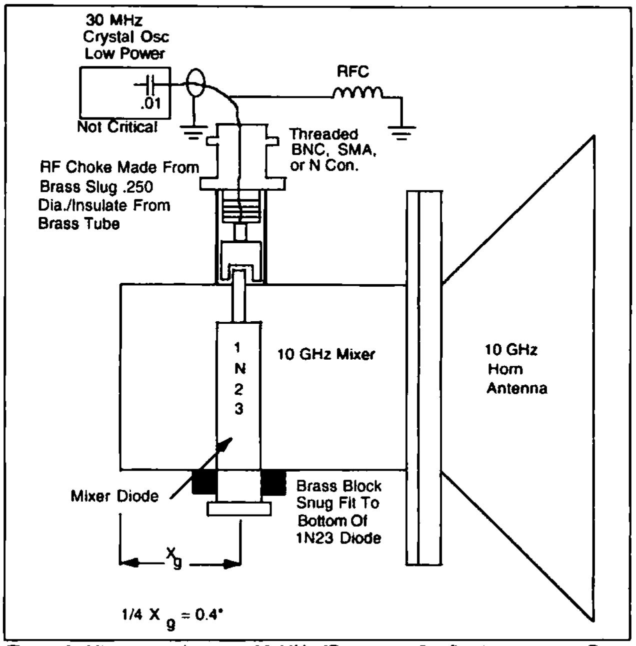


Figure 3. Microwave detector, 30 MHz "Boomerang" reflection antenna. Brass tube size to fit BNC, brass choke 0.259 long with hole to fit 1N23 diode with other end soldered to connector. Insulate with Scotch tape from brass tube, diode bottom grounded in brass block.

The Gunn oscillator and attenuator and transition are all bolted together, forming the test signal source. Set the

attenuator to minimum power and determine attenuator range. For instance, if you are working on a receiver preamplifier you might need maximum attenuation of 40 dB or so to prevent overloading a preamplifier. Once you get preliminary alignment of an RF preamp, more attenuation might be in order. In the case of the multi-stage preamps (three-stage), they can have 26 dB gain and as such require the minus 40 dB of input power to provide meaningful adjustments. You cannot adjust an overloaded amplifier; it's all mush in this case. It's better to underdrive a preamp or amplifier stage in the preliminary adjustment stages to be able to see small amounts of gain as you tune the circuitry.

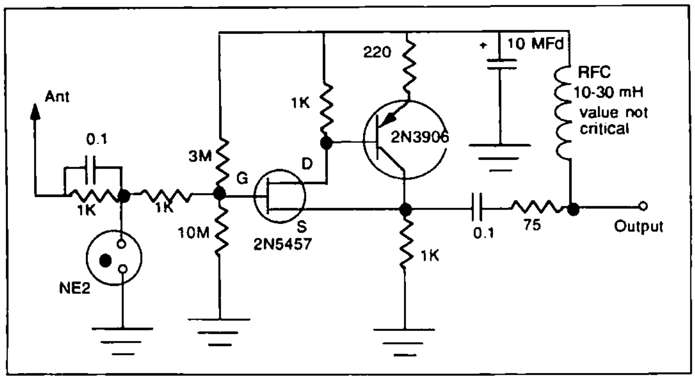


Figure 4. Schematic diagram VLF active antenna amplifier. Mount preamp at base of virtical antenna. Length of antenna is 10 to 20 feet.

Remember, RF preamplifiers work in the very low dB range on the input of a antenna. At 10 GHz (or any frequency for that matter) minus 105 dB is the equivalent to 1 microvolt sensitivity. Zero dB is 1 mW of power, and a 10 mW Gunn oscillator puts out +10 dB. For reference: 100 mW of power is +20 dB, 1 watt is +30 dB, and 10 watts is +40 dB. Set your attenuator accordingly to the test amplifier you are working with. I am working on retuning the Qualcomm 14 GHz 1 watt power amplifier a level of about minus 15 dB seems about nght. (Amplifier boards are described in the June 1994 "Above and Beyond" column).

Normally, the 14 GHz amplifier requires about minus 5 dB to provide full 1 watt output, but when retuning, reduce the level to prevent saturating stages with RF. Stages that are in saturation do not show tuning adjustments at all. With lower power drive in the -18 dB or so range, small tuning increments are very apparent. This is one topic I will get into next month in detail, after you have had a chance to put the test generator together. Both Kerry N6IZW and I use this method on our workbenches to align or convert circuitry for amateur use.

Diode Detector Mount

Another simple test adjunct that can be put to use in the kit of tools for microwave circuitry is the diode detector mount. This single device can be used in quite a few applications, all very useful. You can make a field-strength meter or relative power meter, or a boomerang for wideband FM test alignment. The basic detector mount is a microwave diode (usually a 1N23) housed internal to a short transition-like holder that is fitted with a coaxial connector. Usually the coaxial connector on a detector is elevated somewhat from the waveguide to allow room for the diode connections. Figure 3 shows a typical diode detector. The small tower contains connections between the diode and an RF choke and the connector center connector.

The RF choke is nothing more than an insulated metal sleeve made from brass. Its impedance, at 10 GHz, is very low, making it an RF choke, but at say 30 MHz it's invisible, save for a few pF of capacitance. Its job is to remove 10 GHz energy and allow the IF frequency to pass. One side of the diode connects to the bottom of the choke and the coaxial connector center connector connects to the other side. The side walls are insulated with mylar or scotch tape. I have constructed detector mounts with copper pipe for the short lower section, drilling holes in the RF choke top and bottom to fit the top of the 1N23 and the coaxial connector center conductor. Adjust dimensions to allow the pin of the connector and the tip of the diode to make a good connection when all is held together.

Insulate the RF choke and make sure nothing shorts out the diode and RF choke connection. It's all above ground. The other side of the diode is grounded in a tight fit. Whether you purchase a detector mount or construct one, both should work well in these two applications. First, a simple

detector can be constructed by placing a microamp meter from the detector output to ground. It will respond to incoming RF and give you a simple test of relative RF. For increased sensitivity, connect a single-stage amplifier for more sensitive meter indications.

A single 3130 op amp will do the job. See Figure 4 for schematic details for the amplifier stage. Construction is not critical and can be dead-bug style on the back of your meter to keep the size small. I placed mine in a small metal box to prevent stray interference, and mounted the detector on the output flange of a waveguide frequency meter. I use this setup to calibrate 10 GHz wideband FM Gunn oscillators to proper frequency.

The Boomerang

The detector mount can also be utilized to construct a reflection signal test set. It's been called the "boomerang," and in function it does just that. It reflects a microwave signal back to the source of radiation, but not like a mirror: It will translate your frequency back to your receive frequency. This assumes you are using a 30 MHz IF. If you use other frequencies, change the crystal oscillator to suit your IF frequency.

A boomerang is nothing more than a detector mount at the microwave frequency, to which is coupled a source equal to your IF frequency. In this case, using a 30 MHz IF, a simple 30 MHz TTL-type crystal-can oscillator, will work just fine. High power on the oscillator is not necessary. A feed directly from the oscillator coupled with a 0.01 µF capacitor will work well. Tie the detector diode to ground return with a 30 MHz type RFC. The value is not critical.

What happens is that when you aim your 10 GHz wideband FM transceiver at the boomerang it detects your incoming RF and mixes it with the 30 MHz oscillator, generating a difference frequency, and reflects that mixed frequency back towards your receiver. If your receiver is sensitive enough and you have not placed the boomerang too far away, the receiver will detect it. As you make sensitivity adjustments in the receiver or antenna system you will see a higher return signal for your efforts. A single station can use the boomerang for system sensitivity evaluation or antenna aiming tests.

Update: VLF Active Antenna

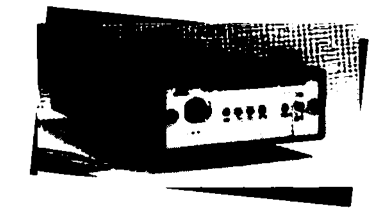
At present, several simple schematics have surfaced concerning active antennas to be used in the 100 kHz range. Figure 4 shows the simplest type—an FET input to match the very high impedance of a short wire or whip antenna at 100 kHz. The FET is connected in a Darlington configuration with a small-signal PNP transistor. The circuit is set up not for a lot of gain but rather for impedance matching of the very high impedance whip antenna.

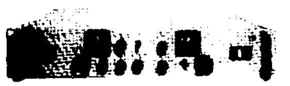
A 100 kHz antenna with a feed impedance close to 50 ohms would be 1/4 wavelength long. At 100 kHz you would need a weather balloon to loft that piece of wire. As the length is shortened the impedance increases, and with a very short piece of wire the impedance is very high, requiring matching. The neon bulb, an NE-2, is in the circuit to short the input with high RF input surges like lightning, to protect the amplifier.

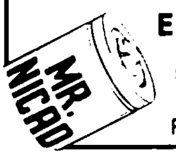
Construction is not critical. For best performance, the amplifier should be mounted at the base of the antenna, being powered from the Loran receiver, which feeds 9 volts DC up the RF coax. An alternate antenna for a quick test is a 20-foot vertical wire or whip tied directly to the receiver. It works for a quick test if signals are strong. This is by no means the last word, but a report on one version of a active antenna for VLF use.

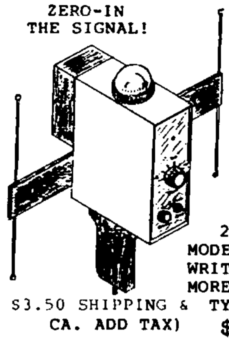
You might want to know why coils are absent from this design. Well, with LORAN pulse operation, any tuned circuit not broadbanded enough would impair the pulse nature of LORAN signals. In other words, a sharp filter-like circuit would cause the receiver to be inoperative.

Well, that's it for this month. In the January issue I plan to describe switching-type power supplies used to power numerous circuits requiring voltages greater than 12 volts. Circuitry will be discussed that will allow you to operate 15 to 24 volts of any polarity from a negative grounded 12 volt battery. As always, I will answer questions concerning this and other related subjects. Please send an SASE for prompt response. 73 Chuck WB6IGP.









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Troubleshooting Kits

Since this month's theme is kit-building, I thought it might be fun to take a took at the process of fixing those kits. At first thought, it might seem as if servicing a kit would be no different from repairing anything else. There is a difference, though, because with a piece of commercial equipment, you know that it once worked! With a kit, you have no such guarantee. Also, with factory-made gear, the quality of construction is expected to be at least fairly good. (Of course, that isn't always the case!) With kits, the construction can vary from great (you built it yourself, and you never make mistakes) to atrocious (that guy at the hamfest said the guy he got it from had a 12-year-old nephew whose friend put it together). So, how do you start when you're confronted with a dead kit?

Who Made-a da Radio?

Well, who *did* build the darned thing anyway? If you did, you're way ahead. At least you know you didn't put any parts in backwards, or make solder bridges, or leave something out, or misread the color code and put a 100k ohm resistor where a 1k ohm part was supposed to be. What, you aren't so sure about that? Surprise—you're not alone. In fact, lots of experienced, competent kit-builders make mistakes they'd be shocked at if someone else made them. It really pays to go back over the thing, step by step, until you have eliminated human error from the possibilities.

The best way is to pretend to build it all over again. Get the instructions and start from step one. OK, you don't need to inventory all the parts. It wouldn't hurt, though, because your unit's trouble could be due to an incorrect part that came with the kit. If you didn't notice it the first time, you might catch it now. And, from what I've seen and heard, most people don't bother to do the initial parts inventory anyway. So, I take it back; you *should* check that each part called for is the same as the one actually there.

OK, they're all present, but did they wind up in the right places? Inadvertent swapping of components is a big cause of kit failure. Check each part, paying particular attention to resistors, because of the color code issue. It's very easy, even for experienced techs, to make errors, especially on the multiplier band. No one is likely to mix up a 4.7k ohm resistor with a 33k, but the only difference between 10k and 100k is that the final band goes from orange to yellow. I don't know about you, but I sure have made that mistake when the light wasn't bright; the two colors just aren't that far apart.

Check also that capacitors haven't gotten mixed up. Most kits' schematics specify caps in the standard American format, such as 0.1 µF or 100 pF. But, lots of parts come in the Japanese format and have markings like 104. What's a 104? That's a 0.1 µF! And 103 is 0.01 µF, and so on. Unfortunately, kits containing such parts often have no mention of the different markings in the instructions. The same problem can exist for inductors, but not that many inductors are marked using the Japanese system.

Another common cause of kit problems is reversed components. Polarity isn't an issue, of course, with resistors, non-electrolytic capacitors and most inductors. But, with electrolytics and semiconductors, it's crucial. An incorrectly oriented transistor, diode or integrated circuit just isn't going to work. With the electrolytic and the IC, the first application of power most likely will destroy the part. Transistors and diodes fare better; often, reinstalling them property will correct the difficulty with no harm done. But not always. If you see or smell smoke, expect to need some new parts. There's a big secret the manufacturers don't tell you: Electronic parts run on smoke. Once you let it out, they don't work anymore!

If all the parts are in the right places and correctly oriented, why the hangament doesn't this thing work? Well, the number one cause of all kit problems is poor soldering. It's not hard to learn to solder, but many people just never take the time to learn, or they have no one to teach them. As the number of technically inclined Americans dwindles, the lack of Elmering is getting to be a serious problem.

So, go over the kit, joint by joint, looking for cold solder joints and, especially, solder bridges. You'll almost never find a bridge in commercially-built equipment, but kits are very prone to this problem. There are three reasons. First, manufactured gear is wave-soldered, not hand-soldered. It's a much more controlled process and, in conjunction with the solder masking on the boards, makes bridges nearly impossible. Second, many kits have little or no solder masking, exposing much more copper to the likelihood of a bridge. Finally, many people don't have the manual dexterity to solder today's tight boards, or they're just plain careless.

Once you're sure the kit is properly soldered, you should be in business. If it still won't work, you're left with some analysis. If you built the kit, then you know its history. If it worked at first and then died, you've got a standard troubleshooting case on your hands. If, though, it never worked, then you can assume a mistake somewhere. Sometimes, those errors can be pretty obscure.

Oops, a Misteak

I remember one rather complex Heathkit I put together years ago. It had lots of ICs in sockets. I was *very* careful over the many hours of construction, and I sure was disappointed when the darned thing wouldn't work properly. After lots more hours of oscilloscope troubleshooting, I found that some of the IC pins weren't making contact inside the sockets. Turns out I had used a little too much heat when soldering them, causing some of the plastic inside to melt and form a film around the little metal receptacles for the pins. Some new sockets fixed it all up. Was it my fault? Maybe, but I'll never be sure. Perhaps they were overly cheap sockets intended for wave soldering. I don't know.

While I'm strolling down memory lane, I recall another kit I made. This one smoked big time when I plugged it in. I was very upset, assuming I'd done something terribly wrong. It turned out that the power transformer was completely shorted. A call to Heathkit brought another transformer in a couple of days (how's that for service?), and the unit worked fine. I miss those people.

I Didn't Do It

If someone else built the kit, you have no idea whether it ever worked. For that reason, I often avoid buying used kits at hamfests. But, if you do buy one, take a good look at it. If it's very new but doesn't work, it's a safe bet it never did. If it's older, it probably did work at one time and died later. Also, the quality of construction should be obvious. If the soldering looks lousy, or the unit is covered with yellow tobacco tar, you're in for a real job. (I don't know why those two things so often go together, but I've seen it time and again. Perhaps people who won't take care of their own bodies also don't take care of their equipment.)

Whether the kit ever worked or not, consider that it may have been improperly adjusted. That's especially true with radio equipment, which often has lots of oscillators and tuned circuits to adjust. Even in commercial gear, the consistency of adjustment leaves a lot to be desired. With home-built gear, it's almost a given that the thing will be at least somewhat out of whack. So, while I always strongly suggest that people not diddle with their commercial radios' adjustments, the opposite is true with kits, especially when you don't know their origin. Some of those old Heathkit receivers can seem quite dead if they're out real far, and a few quick turns of some coil slugs can bring them back to life in a jiffy. But, don't start doing that unless and until you are quite sure nothing else is wrong. Also, don't do it unless you have the manual and whatever test equipment is required to set things right. Otherwise, you run a great risk of making things worse than they already are, with no way to undo the mess.

Do It!

If you've never home-brewed anything, a kit is a great way to start. Even if you've built lots of things, kits can be fun, and they also can get you things you want at reasonable prices. In particular, there's lots of QRP gear available in kit form, and it's very nice. Frankly, if I wanted a small QRP transceiver, I'd rather build one from a kit than start from scratch. What the heck, why reinvent the wheel when somebody else has already figured out a good one?

So, I wholeheartedly recommend kits. Just remember, when you're faced with a broken one, some of the troubleshooting rules are different. Until next time, 73 de KB1UM.

73 INTERNATIONAL

Number 25 on your Feedback card

Arnie Johnson N1BAC
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Notes from FN42

It's that time of year again as I sit down to write this month's episode, my semiannual pilgrimage to Hosstraders in Rochester, New Hampshire. It's a happening, a fun time, time to greet old friends and meet new ones, check out the new gear and the old "boat anchors," and wish that you had brought more money for those treasures that they just don't make like that anymore.

It's an outdoor event, with the commercial interests located inside buildings. It can be hot (in the 80s or 90s in May) or below freezing at night in October. The sun can be shining brightly all day (bring the sunscreen), or there may be blowing rain, sleet, or snow. It doesn't make any difference—there will be thousands of dedicated hams lining up at the gates to enter.

And last, but not least, one of the best reasons to attend is that all the proceeds (beyond expenses) go to the Shrine Hospital in Boston. All entrants give the money directly to the Shriners at the gate, and many of them are your fellow hams.

Before we continue on to the latest in the happenings around this great world of ours, my hearty congratulations to Hans van de Groenendaal ZS5AKU for his appointment as the IARU Satellite Adviser. Hans has contributed information from South Africa as 73 Hambassador and as a satellite contributor. I'm sure that he will do a great job for all of us in this post.

Mora news next month from Lorbie DU1CHD, Cho Byong-Joo HL5AP, and whatever else shows up in the mailbox.

Roundup

Australia *Submission by Richard Murnane VK2SKY:* "DX-ING WITHOUT PREJUDICE" *or* "The Carefully-Worded QSO."

I cast a bloodshot eye toward the station clock. 18:35 UTC. Just gone half-past four in the morning. I couldn't let go, not just yet.

It had been a good night for DXing. Despite the generally declining conditions, 20 metres had been open to all continents, and I had made the most of it. Several hundred logbook entries, each harder to read than the one before, but there would be a good haul of QSL cards out of that lot. Not bad for one night's work.

As dawn approached, the bands had closed, and my eyes felt ready to do the same. My last CQ had gone unanswered, and a final listen around the band turned up nothing but background noise, hushing me to sleep . . .

As I reached for the power switch, a lone voice appeared, calling in the wilderness. Had it been something mundane, like a *JA* or a *W6*, I would probably have let it go, but it was an unfamiliar prefix: *L1*. Now, where the heck was *L1*? Perhaps one of those new Yugoslav republics . . . I'd check later. Hmm, and he was operating portable. Not a bad signal, considering. I returned his call.

"L1TIG/8, this is VK2SKY. You're five by four in Sydney, Australia, over."

"VK2SKY, I think it was, you are five by three here. The name here is . . . " He broke off. After a long pause, he came back again, somewhat hesitantly, "umm, I mean, *without prejudice*, your signal is five by nine, *I think*."

This took a moment to sink in . . . there was no fading on the band, so the dramatic change in the report was a bit of a surprise. But that curious phrase, *without prejudice*, what did he mean by that? Perhaps I had misheard him. I resorted to the old trick used by every Amateur who gets caught not paying attention; I blamed it on QRM. Before I could pick up the microphone again, another station came on the air.

"Break—This is L1BEL . . . the VK station, you're a good 59+20dB at my QTH. It *appears* that the other L! is experiencing a temporary technical problem with his station. I can see no other reason for his allegation that your signal was any less than perfect, old man . . ."

For a moment, I was speechless. Then, yet another new prefix, a *CØ*, broke in.

"Break—I object to the age-ist and sexist language used by L1BEL . . . *'old man'*, indeed! The VK, if you wish to pursue the matter through the courts, I think you have the makings of a pretty solid legal case . . . CØURT on the side."

I had no idea what the last station was on about, but I was suddenly wide awake, frantically searching for my pen to write down all these new callsigns. I scrambled among the callbooks and notepads before I finally found it. I started scribbling, but as Murphy would have it, the pen wouldn't write.

"All stations from VK2SKY, please stand by, my biro isn't working . . . "

Suddenly, all three DX stations howled back in unison, *THAT'S DEFAMATORY!*

I blinked, several times. What had I said?

A new voice chirped up (*D3FAM*, I think), "You should be aware that 'Biro' is a registered trademark. Your inference that the products made by that company are defective in any way leaves you wide open to prosecution under international law. What kind of Amateur are you, anyway?"

"I . . . I . . . " What answer can any Amateur give to that one?

"D3FAM from CØURT, just what are *you* implying? Your last comment has defamatory implications as well, so watch your step."

"Hey, you can't threaten me on air—that puts you in breach of ITU regulation number . . . um . . . hang on, I've got a copy of them right here. Stand by one . . . "

"L1BEL here. I think we're getting off the track . . . We haven't resolved the issue of L1TIG/8's derogatory signal report to the VK station. It implies that the VK's ability to maintain the technical standards of his station is less than satisfactory, not to mention the totally unjustified criticism against . . . uh, the VK, what make of rig are you using there?"

"Yaesu," I replied, as a dull throbbing developed around my temples.

" . . . yes, against Yaesu. Now we all know the good standing of Yaesu in the area of field of Amateur communications, but here we have L1TIG/8," he paused for breath, *allegedly* saying words to the effect that the VK's equipment is performing badly, due to some unspecified failure of the manufacturer to adhere to generally accepted principles of industrial quality control, and/or the failure of the VK station to operate the equipment in accordance with the manufacturer's directions. It appears that L1TIG/8 is calling the VK an idiot and, in my opinion, the VK has an *excellent case . . .*"

"*Hey, look, I never sa . . .*"

"Charlie Alpha Five Echo here—did somebody call me?"

"Hey, CA5E's jamming the LI station. There's potential there . . ."

"You mean, *it appears that* CA5E is jamming . . ."

"Yes, of course, thanks for that . . ."

"No problem. I'll send you my bill."

"Get lost! I didn't as for your advice."

"True, but you *accepted* it. By implication, we have a contract . . ."

"We do not!"

"L1BEL from TØRT, it sounds like he's calling you a liar, and we all know that . . ."

Once again, they all chorused, "*THAT'S DEFAMATORY!*"

"Hey everyone, I've got a JA on the packet cluster who says he works for Yaesu's legal department . . ."

"*Allegedly* works for . . ."

"Before I acknowledge that last station, how much is it going to cost me? . . ."

"Break from TR1AL . . . can I remind you all that it's illegal to conduct business on the Amateur bands?"

I felt I was now on shaky legal ground coming back on the air . . . for a while, I considered taking legal advice, but it was still too early in the day to call my solicitor. Instead, I lapsed into a troubled sleep. When I awoke, 20 metres was once again a jungle of static.

Later that day, I finally threw away my copy of *The ARRL Handbook*, and took out a subscription to *The Australian Lawyer.*

[The end—usual disclaimers, all callsigns (except mine) are fictitious, any similarity, etc., etc.]

Sent in by Richard Murnane VK2SKY, 7/15 Grafton Crescent, Dee Why 2099, previously published in his local ham rag, "Amateur Radio Action."

Taiwan *FAX from the Chinese Taipei Amateur Radio League (CTARL):* We are very pleased to announce that the 1st club radio station is now available in Taiwan by CTARL Hq. The callsign is BV5Y. QSL via CTARL Bureau, PO Box 73, Taipei 100, Taiwan, R.O.C. 73 de Bolon Lin, BV5AF, President of CTARL

USA *Downloaded from the WA1YTW Packet BBS:*

From: K5ARH@K5ARH

To: SAT@AMSAT

Subject: IARU APPOINTS SATELLITE ADVISOR

HR AMSAT NEWS SERVICE BULLETIN 274.01 FROM AMSAT HQ

SILVER SPRING, MD OCTOBER 1, 1994

TO ALL RADIO AMATEURS BT

IARU Appoints Satellite Adviser

In a news release dated 28-SEP-94, the International Amateur Radio Union (IARU) announced that it has appointed Hans van de Groenendaal (ZS5AKV) *[73 Hambassador to South Africa and regular contributor]* to the newly created post of IARU Satellite Adviser. According to the IARU release, the principal task of this position will be to keep the IARU Administrative Council informed on all technical and operational aspects of the Amateur Radio Satellite Service in order to enable the Council to adopt appropriate policies to advance the interest of the Amateur Satellite Service before the International Telecommunication Union (ITU) and regional telecommunications agencies.

The IARU release noted that ZS5AKV, as past President of Southern African AMSAT and an Executive Committee member of IARU Region 1, brings many years of satellite-related experience to this appointment. The IARU release further noted that the appointment is a direct result of recommendations made to the IARU Administrative Council by the IARU Ad Hoc Satellite Advisory Committee, which took up the interim report at the recently completed IARU Administrative Committee meeting in Singapore. The IARU release commented that this action is "tangible proof" of the IARU's interest and involvement in the Amateur Satellite Service.

The release continued by citing IARU's many-year role in protecting the Amateur Satellite Service, in particular its work during the 1979 World Administrative Radio Conference, which led to most of the present Amateur Satellite Service frequency allocations.

The IARU release also stated that the "exponential development of new technologies and ever increasing complexity of the Regulatory Agencies, the IARU Administrative Council deemed it necessary to involve itself closer with the Amateur Satellite Service in order to represent it effectively on a coordinated world-wide basis while cementing its relationship with the AMSAT and other

Amateur Radio Satellite groups."

In the release, the IARU said that in his new capacity and by the powers delegated to him by the IARU, ZS5AKV will have the task of appointing someone to the post of IARU Satellite Frequency Coordinator.

The IARU said that ZS5AKV is now soliciting nominations for volunteers willing to serve the function of IARU Satellite Frequency Coordinator. Such nominations should be sent to him by FAX at +27-31-765-6456 or via INTERNET at amsat@uctvax.uct.ac.za before 31-OCT-94. Hans said that each nomination should include a comprehensive summary of the nominee's background and qualifications. He stated that it is his intention to discuss the various nominations with major AMSAT groups in order to seek their recommendations. He underscored the importance of finding the right person to be appointed to this very important job.

AUSTRALIA

David Horsfall VK2KFU
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Wahroonga NSW 2076
Australia

The "hot news" in Australia is that licence fees are no longer payable for CB Radio (known more formally as the Citizens Radio Service). What has this got to do with Amateur Radio? Well, it seems that the regulatory body—the Spectrum Management Agency (SMA)—has to make up the shortfall somehow, and rumours are abounding that all "fixed" radio sites (e.g. Amateur repeaters) will attract a fee of AU$800! Naturally, I will report on subsequent news in a future column.

There is some concern that offensive and possibly defamatory messages can be distributed via the packet radio system, and it appears that the "Sysop" of every BBS in the path can be held responsible. The Wireless Institute of Australia (WIA) is looking at this problem, with a view to making a recommendation to the SMA (before they do it for us). It is likely to involve some form of authentication at the originating BBS, and the system in the USA (where only the first BBS is responsible) is being looked at. It is a shame that such measures are deemed to be necessary, but it seems to be a reflection of society as a whole.

Cheers for now. Those with access to packet or Internet can contact me as "VK2KFU @ VK2AAB.SYD.NSW.AUS.OC" and "dave@esi.COM.AU" respectively.

PEOPLE'S REPUBLIC OF CHINA

Rick Nul BZ1QL
Room 316 Building 25
Tsinghua University
Beijing 100084
People's Republic of China

KATMANDU . . . A goodwill package of RTTY Digital Journals was airmailed to the Nepal Amateur Radio League (NARL) from TUARC in early August, relaying our "good luck" message to the developing 9N1 amateur community. Satish 9N1AA has been active on Pactor these days and is also the key person getting things going in NARL. He can be reached via digital as 9N1AA @ JA5TX.JPN.AS or by airmail at PO Box 4292, Katmandu, Nepal.

HAM EXAM . . . The first-ever national Amateur Radio License Examination was held July 10 and 17 in Beijing, Shanghai, and other big cities. Thousands of people participated in the exam, and every testee must be a formal member of CRSA, the Chinese Radio Sports Association. Four different classes of licenses are available this time, with Class 3 (CW/SSB) the highest. A good number of BG licenses may be released soon.

AMP & MIKE . . . Right now we are in dire need of a 70cm amp for satellite uplink and a Yeasu microphone that fits the FT-726R transceiver. Both amp and mike presently used are malfunctioning and are hard to repair. We would appreciate your aid or donation to help China obtain a satellite of better quality.

STATS . . . As of September 3, 1994, BY1QH has worked a total of 309 stations in 37 countries on satellites.

TUARC can be reached via any of the following paths: Pager—204-6677 beep 5552 (local only); Digital—BZ1QL @ JA5TX.JPN.AS; Internet—bz1ql%ja5tx@bbs.arasmith.com or bz1ql%ja5tx@bbs.lbc.com.

MONACO

Daniel Plett 3A2LZ
B.P. 349
MC 98007
Monaco

Greetings from Monaco. This summer has seen a wide variety of ham activities in the Principality, especially with visiting amateur radio operators. F1IXQ and F1RWD came and very ably ran a long weekend of satellite operations from Monaco. They were fortunate enough to have a friend from their CB days who had somewhere to put some antennas. In spite of tall surrounding buildings and quite noisy conditions, they kept a reasonable rate of QSOs flowing. They had a rather attractive QSL card printed for the occasion.

OE7HPI came and operated mobile, handing out QSOs on 40 and 20 meters. W5ZPA came with the intention of operating RTTY and helping a number of U.S. hams add Monaco to their list of countries worked on RTTY. Unfortunately, he was not able to get the gear operating correctly on RTTY and resorted to operating some SSB and CW.

When Monaco hams visit the U.S. we are always asked for three types of contacts: 1) Monaco on top band; 2) a YL contact; and 3) a RTTY contact. Top band is quite difficult, primarily because it is difficult to put up any kind of antenna for 160 meters. There are a few 3A hams who have RTTY gear, but to my knowledge, I am the only one active on RTTY. A YL contact is another story. Most of the YLs licensed in Monaco have VHF-only tickets. The few who have full privileges don't like the heavy pileups when they operate. For a long time I have offered European YLs help getting on the air here if they come. It looks now as if a YL from the U.S. will come and operate for a little while towards the end of October.

Finally, I regret to inform you of the death of Jean Bardos 3A2EE. "Echo Echo" was one of Monaco's best-known hams and was very active on a wide variety of modes. He was a long-time member of the council of the A.R.M. and will be deeply missed. Best 73!

NEVER SAY DIE

Continued from page 4

Heck, I've visited all of these countries, have operated from most, have friends there, and still there are a couple I'd have to make an educated guess on the capital. Well, what did you expect, something easy like Paris or Montevideo?

Step one is to get your Advanced license. Step two is to move your family to some place where you can put up a nice big tower and a beam. Remember what's important in life. You're going to need a kilowatt, however a home-built linear or one bought secondhand will keep the cost down. Linears are easy to build. Then, you're going to need to have your own business so you'll be able to take time off when the bands are open or DXpeditions are on.

Sure, you can work 'em with 100 watts and a dipole, but you'll be trading a bunch of time for your chintziness. For instance, when I operated from Kabul I could hear the Big Guns almost every night. The kilowatts with triband beams came through about ten nights a month. The 100-watters could only be heard one or two nights a month.

Worse, when your signal is weak and you're fighting hundreds of other equally weak DXers, you are unlikely to get more than a signal report. It's no fun for someone in a rare country to try and hear your puny signals for long contact.

I remember visiting Mike Ercolino, the president of Telrex Antennas. He had a Collins KW-1 rig and one of his big Telrex antennas. He called CQ Burma and we sat and listened to several XZs answering his call. I was impressed. Little did I imagine that ten years later I'd be visiting these hams. If you can get a four-element 20m beam up around 70 feet, and put a pair of shoes on your rig, you too can have 'em answering your CQs from rare spots around the world. And you can actually sit there and have real conversations with some fascinating people.

The hard part is getting a good location. You're never going to be a Big Gun if you live in an apartment. You need some room for that tower.

Capital	Country	Prefix	You've Worked It	Been There
Apia				
Mbabane				
Katmandu				
Bandar Seri Begawan				
Kota Kinabalu				
Noumea				
Kingstown				
Papeete				
Kabul				
Colombo				
Dar es Salaam				
Maseru				
Suva				
Road Town				
St. Johns				
Roseau				
Point-a-Pitre				
Fort-du-France				
Bridgetown				
Pago Pago				
St. George's				
Castries				
Port of Spain				
Scarborough				
Willenstad				
Kingston				
Plymouth				
Basse Terre				
Charlestown				
The Valley				
Kuching				
Kuala Lumpur				
Charlotte Amalie				

Figure 1.

Ho Ho Ho

Yes, kindly Santa, that cheap old codger, will be around, nagging you to give presents in his name. Well, it is the time of year to remind friends that you haven't yet won that coveted *QST* Silent Key Award. You're probably expecting me to suggest you take care of this with twelve monthly reminders of your thoughtfulness, namely a gift subscription to *73*, right? Hmm, if I'd thought about it, that would have been my recommendation. I'd have mentioned that I have a choice for you, the el cheapo gift subscription, which is $19.97, or the deluxe gift subscription, which is $24.97. Your choice. They get the same magazine either way. This is just a test of how cheap you are. If you've read any of my travel booklets you know how thrifty I am. Thrifty, not cheap.

There's another gift you might consider for your ham friends. This is the first compact disc of ham music. Ham music? The songs were written and sung by Andrew Huddleston and Lissa Ladefoged, OZ1ADL and OZ1XY, and they're good. Darned good! There's one on DXpeditions, another on Morse Code, and the XYL's lament that he's "Always on the air." Andy says, "I'm not climbing up the tower anymore!" There's one about "The trip to Dayton," where Andrew and Lissa spent their honeymoon at the HamVention. And I loved "Rootuma Bound," another DXpedition song. The music varies from country to soft rock and it's great stuff. Give yourself one of these for Christmas, and then get some for friends. Ham friends, of course. But then, what else have you?

The CD title is "Seek You." They wanted to call it "CQ" but *CQ* magazine threatened to sue them, so they had to change it at the last minute. I wish they'd called it "73." Maybe their next CD will go that route. The disc is by Last Resort Records. You'll be able to buy it direct from Last Resort, or from Uncle Wayne's Bookshelf.

Now, let's get the CD and start sending the digital information on the CD over the air. Yes, it's legal to send music over the air . . . if you do it digitally.

Incentive Licensing?

Since "Incentive Licensing" was the biggest disaster to ever hit ham radio, with the fallout still being felt, I tend to mention it frequently. And since this catastrophe took place 30 years ago, newer readers are often confused, tending to think it has something to do with the current licensing system, which seems innocuous enough.

I've printed all this stuff before. Many times. But for those who are new, I'll cover the ground again so you'll know more about why the hobby is in the shape it's in today.

It was the perception of "incentive licensing" that did the damage, not the actuality. It all started with an editorial in the February 1963 issue of *QST* which said that the League felt something was wrong with amateur radio and something ought to be done about it. They didn't say what was wrong exactly, so there was no way to argue. The implication was that by going back to the pre-WWII licensing system of two license classes, A and B, that the problems, whatever they were, would be fixed. This all came about when the Hudson Division director, multimillionaire Mort Kahn W2KR, who actually was running the League after his successful overthrow of General Manager Budlong W1BUD, proposed the change.

The ARRL Board refused to touch this hot potato at their yearly board meeting, putting it in the hands of the executive committee, which was dominated by Kahn. Kahn then sent a petition to the FCC without even informing the board, much less getting their okay. The petition asked that General Class licensees be forced to get an Advanced Class if they wanted to continue to operate on the 15-20-40-80 meter phone bands, as it was before The War. The "incentive" part was that if you wanted to continue operating on phone you had to upgrade. With over 90% of hams operating on phone, this was a devastating blow to the Generals.

Tens of thousands, who didn't want to have to take the test, just gave up and sold their ham stations for whatever they could get. Ham gear was soon going for 10¢ on the dollar, which caused the sale of new ham gear to plummet by almost 90%. This not only put virtually every ham manufacturer out of business, it also killed off over 85% of the ham radio stores, and all this happened in about one year. Blown away were Hallicrafters, Hammarlund, National, Millen, Multi-Elmac, Gonset, B&W, Lakeshore Industries, Central Electronics, Sideband Engineers, Thordarson, Stancor, and so on. Collins stopped all further development of new models and moved their manufacturing for the military to Japan.

"I'd like to see one license exam which tests for technical knowledge and not code skill, and which would then entitle everyone to use all ham frequencies."

It took five years for the FCC to finally act on the petition. The bitter fight I put up against it in *73* magazine resulted in the FCC taking away only half of the phone bands from the General Class instead of all of them, and this despite tremendous pressure from the ARRL and what was left of their ever-obedient affiliated clubs. The end result was that Generals, if they wanted to work much DX, had no choice but to get their Advanced or Extra Class licenses. That's the incentive of "incentive licensing."

Frankly, I see no good reason today for so many license classes. I'd like to see one license exam which tests for technical knowledge and not code skill, and which would then entitle everyone to use all ham frequencies. I'd like to see ham clubs recruit,

Number 26 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event.

DEC 3

GREENSBORO, NC The 14th annual Greater Greensboro Hamfest and Computer Show will be sponsored by the 76 Group at Greensboro Coliseum Complex Special Events Center, 1921 West Lee St., 9 AM-4 PM. Flea Market, Commercial Booths, VE Exams (pre-register), Computers, more. Talk-in on 145.250(-) and 146.760(-) Contact *76 Group, P.O. Box 7862, Greensboro NC 27417-0862*, or call *REALTALK, (910) 299-2525. Enter 0076* at the prompt.

MESA, AZ The Superstition ARC Hamfest will be held at Mesa Community College Campus, NE corner of Dobson Rd. & SR 60 (Superstition Freeway). For info, call *(602) 898-9158*.

NORTH OLMSTED, OH The North Coast ARC Fall Hamfest will be held at St. Clarence Church, 30106 Lorain Rd., 8 AM-2 PM. Setup at 0600 AM. Vendors purchasing four or more tables may set up Fri. eve. 7 PM-10 PM. Reservation payments must be received (with SASE) by Nov. 26th. Send to *Dan Sarama KB8A, 15591 Rademaker Blvd., Brook Park OH 44142. Tel. (216) 267-5083*, or connect to the *NCARC Packet BBS, "C NO8M" on 145.73. Dial (216) 779-6350* and use the commands: *D NCARC/HAMFEST.LOC* and *D NCARC/HAMFEST.INF.* Talk-in on 145.29 and 224.76 Rptrs.

DEC 4

HAZEL PARK, MI Hazel Park H.S., 23400 Hughes St., will be the location for the 29th Annual Swap and Shop sponsored by the Hazel Park ARC. Admission $4, tables $13 (check must be sent, no reservations by phone). Talk-in on 146.64(-) (DART). For info, tables, tickets, write to *HPARC, Box 368, Hazel Park MI 48030*.

DEC 10

FARIBAULT, MN The annual Courage Center Handi-Ham Winter Hamfest will be held at the Eagles Club, starting with registration at 8:30 AM. There will be a Handi-Ham Equipment Auction, Flea Market, Dinner at Noon, and Program. Talk-in on 19/79. Contact *Don Franz W0FIT, 1114 Frank Ave., Albert Lea MN 56007.*

JACKSONVILLE, IL Three major clubs are coming together to sponsor a Superfest at 8 AM in the Turner Jr. H.S. VE Exams, Flea Market. Crafts welcome. Contact *Tim Childers, (217) 245-2061*. Talk-in on 146.775 Rptr., and on 146.52.

JAN 8

MILWAUKEE, WI The 23rd annual Mid-Winter Swapfest will be held at the Waukesha Co. Expo Center Forum from 8 AM-2 PM. Advance reservation deadline is Dec. 23rd. VE Exams; please pre-register. Sponsored by the West Allis RAC. Write with SASE to *WARAC Swapfest, P.O. Box 1072, Milwaukee WI 53201.*

SPECIAL EVENT STATIONS

DEC 2

SAN ANGELO, TX The San Angelo ARC will operate W5QX Dec. 2nd 1500Z-2200Z Dec. 4th, to celebrate Christmas at Old Fort Concho. Operation will be in the General portions of the 40, 20, 15m subbands, and the Novice 10m subband. For a certificate, send 9" x 12" SASE to *AB5BG, 1210 Ardmore, San Angelo TX 76905.*

DEC 10-11

BETHLEHEM, IN The Clark County ARC will operate W9WWI to celebrate the Holiday Season. Operation will be in the General 80-15m phone band, the Novice 10m subband, and on 2m. For a certificate, send QSL and SASE to *CCARC, P.O. Box 532, Jeffersonville IN 47130.*

KIMBERLING CITY, MO The Kimberling ARC will operate NQ0G from 1500Z-1900Z both days (Dec. 10 & 11). Operation will be from the Port of Lights, a 1 1/2 mi. drive through an animated Wonderland of Lights. This event is being sponsored by Table Rock Lake/Kimberling City Area Chamber of Commerce. Look for them in the lower portions of the 80, 40, 20, and 15m bands. For a certificate, send QSL and SASE to *Chamber of Commerce, P.O. Box 495, Kimberling City MO 65686.*

DEC 17-18

NAZARETH, PA The Delaware-Lehigh ARC will operate W3OK 1400Z-0200Z Dec. 17-18 from the Christmas City. Frequencies: 3.965, 7.265, 14.265, 21.365 and 28.365. For a certificate, send QSL and SASE to *DLARC, RD4, Greystone Bldg., Nazareth PA 18064.*

JAN 1

LOS ANGELES, CA The Spanish Int'l Western ARC will operate from Los Angeles CA USA, and from Central and South America 1600 UTC-2400 UTC to celebrate "Feliz Ano Nuevo America." Frequencies: 21.340 USB and 7.260 LSB MHz. Listen for Stations N6TOO, KC6GJD, N6TBX/TG8 and LU9FAN. For a certificate, send QSL to *Spanish Int'l Western ARC, P.O. Box 2082, Seal Beach CA 90740 USA.*

teach the theory and operating skills, and license newcomers . . . and to be responsible lor their recruits. I'd like to see clubs have the power to license and de-license, and get the FCC out of our hair as much as possible.

When we get interested in RTTY we have to learn about it. Ditto satellites, packet, slow-scan, and so on. These interests are an incentive for continued learning.

Mort Kahn's "incentive licensing," which was enthusiastically promoted by Bill Orr W6SAI, was the worst disaster ever suffered by the hobby. It put all the American manufacturers out of business at the right time to open it up for the Japanese to dominate the industry worldwide. Worse, one other result was the demise of over 95% of our school radio clubs, thus stopping the recruiting of teenagers into the hobby. There went the infrastructure which brought us most of our new licensees. Before Kahn's petition, over 80% of our new hams were teenagers. Now it's around 11%. This has stopped over two million youngsters from pursuing high-tech careers who otherwise would have. How much of a difference would two million more scientists, engineers and technicians have made to the growth of our American electronics industry?

While we were stopping ham growth in America the Japanese were moving in the opposite direction. They introduced a no-code license which allowed 10 watt phone operation on the low bands. This helped spur the development of ham radio clubs in every school in Japan. They soon had twice as many licensed amateurs as we, and with only half our population. This resulted in millions of their youngsters going for high-tech careers, making possible their world domination of the consumer and other electronics industries.

Now stop asking about "incentive licensing." It's my goal to get radio clubs going in schools again, and to get our schools to teach the fundamentals of radio and electronics, just as they do physics, chemistry, and biology. If we can get millions of kids interested in the hobby, we'll not only keep our ham bands, we'll be able to rebuild our electronics industry.

We know that electronics is a key to our success in competition with the other developed countries, yet we're doing almost nothing to build the needed high-tech workforce.

The 73 International Column

Having visited hams in over a hundred countries, and having DXed from most of them, I'm guilty of trying to force the *73* readers to be more interested in DX than is reasonable. And now, with an ever higher percentage of hams being Techs, the general interest in DX has been falling off, as we've noticed in our reader polls.

When I stop to think about it and put it in perspective, I can understand. DXing is only a small facet of amateur radio, and a good deal of the ops interested in working DX are after DXCC and other awards. Few seem to be really interested in talking with DX ops. Hello, send a card, bye. Thus the low scores for the "*73* International" column.

Arnie Johnson N1BAC has done a fine job of getting reports from DXers all around the world for the column for the last five years. And before him Dick Phenix handled it, but then he retired to a cabin in the super boondocks. I first met Dick when I visited the San Francisco Mensa group about 20 years ago. He then moved back to New Hampshire and was part of the Mensa group here, where I was the Local Secretary for around 15 years.

I do hope our Hambassadors will continue to send us news of what's going on that we can use in our Letters column. And, if I can get things working smoothly again, maybe I'll be able to visit more of them personally. I still want to visit at least 70 more countries before winning my Silent Key Award from *QST*.

"It's my goal to get radio clubs going in schools again, and to get our schools to teach the fundamentals of radio and electronics, just as they do physics, chemistry, and biology."

PROPAGATION

Number 27 on your Feedback card

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

I'm sure that you will notice that "conditions" this month leave much to be desired . . . particularly on weekends. This is due to several factors, which include general decline in the sunspot numbers, seasonal conditions, and just plain chance. You'll also notice that there aren't many days which can be classified as GOOD, so you'll have to make the best out of what's available from the chart. Your best chances are on days that show GOOD or FAIR to GOOD trends. The really POOR days are expected to be the 4th and 23rd, while the rest are trending toward or away from GOOD. If you wish to make the best use of this chart, check WWV at 18 minutes past any hour for their propagation reports and use the information you get which describes today's and tomorrow's forcasted "conditions." Cycle 22 looks as if it may reach its nadir sooner than most forecasters had originally thought, meaning sometime in 1995. That means that Cycle 22 has been a shorter then normal cycle since the last low point of Cycle 21 in December 1986 . . . just nine years instead of the average 11.2 years. Some sun watchers are now saying that the cycles are really 22 years in length and that the 11-year periods are just perturbations in the larger cycle . . . something I don't yet believe, but am willing to consider. Here's your band-by-band forecast this month.

10 and 12 Meters

Only occasional F2 openings to the tropics on GOOD days during daylight hours. Not much sporadic E or short skip propagation can be expected. Skip is where you find it, so keep looking and hoping. Sometimes results are spectacular on a supposedly "dead" band. Really good "gain" antennas can help a lot this month. A good local band.

15 and 17 Meters

Fairly good DX into the Southern Hemisphere during daylight hours from noon to sunset *local* time, and short skip from sunrise to sunset, but expect the band to close soon after—abruptly!

20 Meters

Daylight hours should be pretty good for DX this month in spite of depressed conditions in general, and you may even find the band open until midnight. Peaks ought to occur just after sunrise and late afternoon *locally*. If the band does stay open after dark, look for openings into South America and even Antarctica. Also, during the day, you will find considerable short skip. All of which means that 20 meters should be your PRIME DX BAND. (See 80 meters, too)

30 and 40 Meters

Expect late afternoon and evening openings into Europe and Africa swinging south after sundown for a few hours, but the MUF falls below 7 MHz later in the evening. Short skip will occur during most days out to 1,000 miles or so, and to 2,000 miles at night until the band closes.

For you newer operators who have not lived through a complete sunspot cycle, there will be some great surprises in store. Listen and learn.

80 Meters

This will also be a very good DX band after dark, and since QRN is low, signals ought to be very readable . . . even weaker ones. Peak DX occurs around midnight local time and just before sunrise. Insomniacs will *love* 80 meters this month. Short skip at night will occur frequently out to 2,000 miles. Isn't it interesting how two of our "oldest" bands, 80 and 20, are the best in these times? The old-timers knew what they were doing when they "got" these bands for amateurs way back when.

160 Meters

You "top band" operators will love this band in December: DX openings to the east from your locations, peaking around midnight (Europe, etc.), and toward the south and west before sunrise. Nighttime short skip should also be good from dusk to dawn, getting longer later. On this band, use vertical antennas to transmit and horizontal antennas for receiving, preferably Beverage antennas if you have the room. Low noise and minor static will make you happy.

EASTERN UNITED STATES TO

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA	20	40	40	40	80	80				20	15	15
AUSTRALIA	20		20		40	40	20	20			15[1]	15[1]
CANAL ZONE	15	20	20	40	40		20	20	15	15	15*	15*
ENGLAND	20	40	80	40	40		20	20	20	20	20	20
HAWAII	20		20		40	40	80	20			15[1]	15[1]
INDIA	20/40[1]					20[1]	40[1]	20[1]				15[1]
JAPAN	20						20	20				20
MEXICO	15	20	20	40	40		20	20	15	15	15*	15*
PHILIPPINES							20					
PUERTO RICO	15	20	20	40	40		20	20	15	15	15*	15*
SOUTH AFRICA			40[1]	40[1]				15*	15*	15*	20	20
U.S.S.R.	40	80	80	40			20	20	20			40
WESTCOAST		80	80	40	40	40	20	20	20			

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						80*	40*	20				
ARGENTINA	20		40	40	40						15	15
AUSTRALIA	15					40	20	20	20			15
CANAL ZONE	20	80	40	40	40	40	20	20	15	15	15	20
ENGLAND	40	40	40	80				20	15	20		40
HAWAII	15	20			40	40	40				15	15
INDIA	15*	80[1]	20[1]				40[1]	20[1]	20[1]			
JAPAN						80*	40*	20				
MEXICO	20	80	40	40	40	40	20	20	15	15	15	20
PHILIPPINES								20				
PUERTO RICO	20	80	40	40	40	40	20	20	15	15	15	20
SOUTH AFRICA	20	40*							15	15	20	20
U.S.S.R.	40		40	40				20	20			

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20			40	40	40	40	40			20
ARGENTINA	15	20		40	40	40	40	40		15	15	15
AUSTRALIA	15	20	20				40	80*	40	15	15	15
CANAL ZONE	20	20		40	40	40			20	15	15	15
ENGLAND			80*	40					20	20		
HAWAII	15	15			20	20	20	20				15
INDIA		20										
JAPAN	15	20			40	40	40	40	40			20
MEXICO	20	20		40	40	40			20	15	15	15
PHILIPPINES	15	20					40	40		20		20
PUERTO RICO	20	20		40	40	40			20	15	15	15
SOUTH AFRICA	20	40[1]	40[1]							15	15	20
U.S.S.R.		40[1]	40[1]	40[1]	40[1]				20	20		
EAST COAST		80	80	40	40	40	20	20	20			

1 May be open only once or twice during month. * = Try next higher band. G=Good, F=Fair, P=Poor

DECEMBER 1994

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G-F	3 F-P
4 P	5 P-F	6 F	7 G-F	8 F	9 F-G	10 F
11 F-G	12 G	13 G-F	14 F	15 F-G	16 G-F	17 F
18 F	19 F-G	20 F-G	21 F	22 F-P	23 P	24 P-F
25 F	26 F	27 F-G	28 F-G	29 G-F	30 F	31 F-G

BARTER 'N' BUY

Number 28 on your Feedback card

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

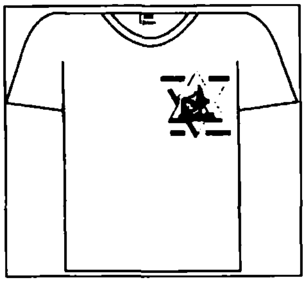
Send your ads and payment to the *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

The deadline for the January 1994 classified ad section is November 10, 1994.

Continued on page 81

NEW PRODUCTS

Compiled by Charles Warrington WA1RZW



CABIN FLAT ENTERPRISES

Now amateur radio operators can identify themselves when working communications for public events or emergency services. These new Cabin Flat T-Shirts feature front breast "Federally Licensed Radio Operator" logo insignia. The back reads "Emergency Communications" in large letters to identify your status.

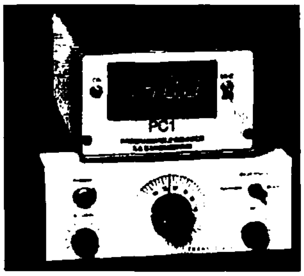
The shirts are high quality 100% cotton, available in sizes L, XL, and XXL in navy blue with white printing. They are priced at $17 each. Special matching caps and jackets are also available. For more information or to order contact *Cabin Flat Enterprises, 23236 Cardinal Road, Box 2423, Wrightwood, CA 92397; (619) 249-5832, (800) 435-3528, FAX (619) 249-4667.* Or circle Reader Service No. 203.

JADE PRODUCTS

The new series of Jade-Pole Antennas from Jade Products is based on a conventional J-pole design using ladder-line technology. They are available for the 2 meter, 220 MHz, and 6 meter bands.

The Jade-Poles are constructed of heavy-duty #18 copper-clad steel conductor and comes with a standard SO-239 connector. The antenna is rated at 300 watts and is usable over the entire band of operation using a 50 ohm coax feedline.

The 2 meter and 220 MHz versions come completely assembled and ready for installation; minor assembly is required for the 6 meter version—complete instructions are included. The antenna is colored white and comes ready to mount on a wall or onto a mast with the optional mast mounting kit. The 2 meter version is priced at $28.95, the 220 MHz version is priced at $27.95, and the 6 meter version is priced at $37.95. For more information contact *Jade Products, P.O. Box 368, E. Hampstead, NH 03826-0368; (603) 329-6995, FAX (603) 329-4499.* Or circle Reader Service No. 202.



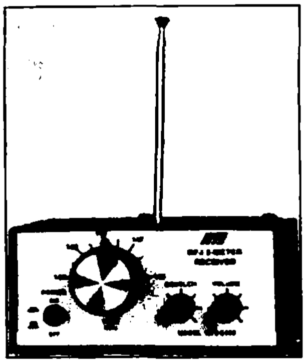
S & S ENGINEERING

Okay guys, here it is! For those of you with offset VFOs who want to read the tuned frequency, S & S Engineering has developed the PC1 Programmable Frequency Counter. Just set the DIP switches for the offset, connect it to your VFO (instructions are free when you provide the schematic for your VFO), and attach 7-15 VDC. You will then know your tuned frequency with accuracy.

The PC1 counts to 40 MHz up or down. It handles any IF offset and backward tuning VFOs. It makes using a VFO rig a pleasure.

The case is just 4" W x 2.5" H x 5.5" D, and the easy to read LED display draws only 150 mA. The PCB is solder masked for easy assembly. The PC1 (kit, no case) is priced at $69.95; the PCC1 (kit with case) is $99.95; the PCA1 (assembled with case) is $139.95, and the AC adapter is $6.95. For more information or to order contact *S & S Engineering, 14102 Brown Road, Smithburg, MD 21783; (301) 416-0661, FAX (301) 416-0963.* Or circle Reader Service No. 205.

MFJ ENTERPRISES



Are you a true ham who loves to build his own gear? True hams will love the new MFJ-8400K Repeater Monitor Receiver Kit for the 2 meter band. With MFJ's build-your-own instructions, you'll enjoy a fun evening building your own high quality tunable receiver and you'll enjoy the finished super-sensitive receiver monitor that'll rival others costing hundreds of dollars more.

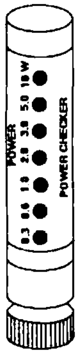
The 8400-K features a low-noise, high gain RF preamp which gives you excellent 0.1 microvolt sensitivity. An air variable tuning capacitor with a velvet smooth 6:1 reduction drive makes tuning easy and comfortable with no noticable drift. The dual conversion superhet design has sharp ceramic filters and a crystal controlled second oscillator for excellent selectivity and sensitivity.

The MFJ-8400K is a complete kit priced at $69.95, and uses a 9 volt battery, 9-12 VDC or 110 VAC with optional MFJ-1312B (priced at $12.95.) The MFJ-8400W is the same radio, prewired and tested, and priced at $89.95. The instruction manual is available free of charge. For more information or to order visit your favorite dealer or contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762; (voice) (601) 323-5869, FAX (601) 323-6551, (orders) (800) 647-1800.* Or circle Reader Service No. 201.

RADIO DEVICES

Radio Devices is the sole US Importer of the new PC705 Power Checker from Revex. This little gadget is a handy RF measurement device that shows the RF power output of low power transmitters (less than 10 watts) in the 20-1300 MHz range. The Power Checker illuminates up to 8 LEDs based on the power applied through the BNC connector.

Simply attach the Power Checker to any HT and you can immediately read the power output and evaluate the status of your batteries. It can also be used as an antenna for short-range communications. No external power is required; the Power Checker is powered purely by the RF applied.



The PC705 is priced at $39.95 (plus $2.90 First Class shipping). For more information or to order contact *Radio Devices, 32 Queens View Road, Marlboro, MA 01752; (508) 480-0502.* Or circle Reader Service No. 204.

OPTOELECTRONICS

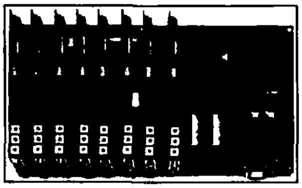
Here's a new device not intended to be used as a test instrument, but rather to detect radio transmitters in the near field. The Scout automatically finds and records frequencies and tunes a receiver. It is the first such device created for this purpose.

For walk-by applications, the Scout can automatically detect and record 200 unique frequencies and up to 250 repeat hits on any that were previously recorded. When used with the miniature DB32 antenna, the Scout will fit in the pocket, operate completely automatically, and will signal the operator when a signal is recorded with a pager-style vibrator. After recording, the data can be downloaded into a computer using the software supplied and an optional TTL to RS-232C converter.

In drive-by mode, the built in beeper signals when the Scout records a new frequency with a double beep. A single beep indicates a repeat hit. Because the Scout is automatic, the driver is not distracted, but can easily monitor activity.

The Scout runs on a high capacity NiCd battery pack has a wide variety of power options, and comes with an AC adapter charger, 3.5" disk with PC compatible utilities, and a comprehensive owner's manual. The Scout is priced at $399. For sales or technical information contact *Optoelectronics, Inc., 5821 NE 14th Ave., Ft. Lauderdale, FL 33334; (305) 77102050, FAX (305) 771-2052.* Or circle Reader Service No. 207.

LINK COMMUNICATIONS



Link Communications Has announced the release of the new RLC-3 Repeater, linking and remote base controller. The RLC-3 supports up to 8 separate or connected radio ports, on one controller system. Each radio port can function as a repeater, link or remote base. The RLC-3 supports separated DTMF decoders, Icom, Kenwood, and Yaesu remote base support, 1000 telephone autodial slots, and over 500 macros. Up to 16 analog inputs, 16 outputs and 16 input lines are supported.

The RLC-3 with four radio ports and a cabinet is priced at $1200; the autopatch option is $100; analog input and output card is $75; and additional radio cards are $250. For more information contact *Link Communications, Inc., P.O. Box 1071, Sidney, MT 59270; (406) 482-7515, (800) 610-4085.* Or circle Reader Service No. 206.